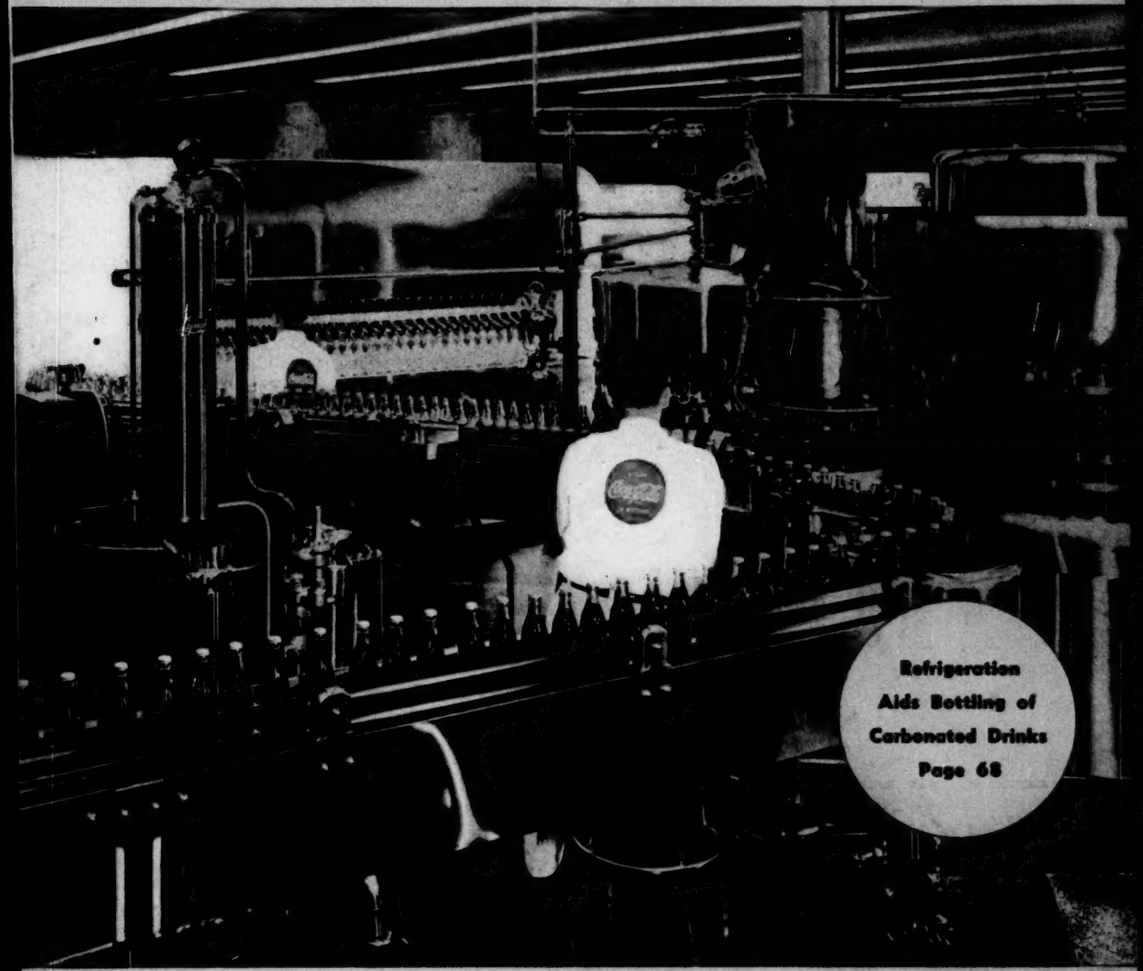
NOVEMBER, 1951

HEATING AND VENTILATING

INCLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION



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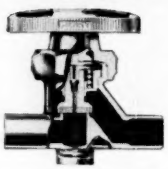
HENRY LINE VALVES really give you something extra

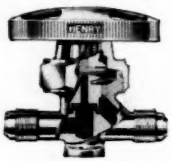
They give more dependable service because of advanced field-proven design and construction as well as patented features.

PACKLESS VALVES
FOR FREON
with Exclusive Balanced-Action



STANDARD TYPE

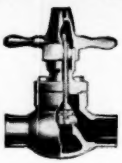
Ball check in balancing channel permits diaphragm inspection and replacement with valves under line pressure. Sizes, ¼" thru ⅝" flare; ¼" thru 1⅝" O.D. Solder, ¼" thru 1" F.P.T.



BLUE BANTAM TYPE

Same as standard Balanced-Action valve except that diaphragms cannot be inspected or replaced under line pressure. Size ¼" thru ⅝" flare and O.D. Solder.

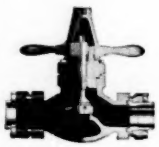
PACKED VALVES
FOR FREON
Bronze-Wing Cap Type



Globe and angle types with solder connections, bolted bonnets, sizes ⅞" thru 5⅛" O.D.

SEMI-STEEL WING CAP TYPE

With bolted bonnets and square companion flanges. Furnished with brass tailpieces (O.D. Solder) 1⅜" thru 5⅛" or with steel tailpieces for welding to pipe, sizes 1¼" thru 5".



Also Globe and angle types with F.P.T. connections, sizes ½" thru 2".

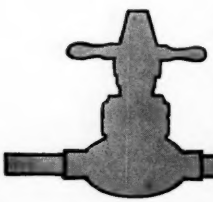
PACKED VALVES
FOR AMMONIA
Permanent-Mold Iron and Semi-Steel

Compact and strong with self-aligning stem disc. Sizes (F.P.T.), screw bonnet: ¼" thru 1", bolted bonnet 1¼" thru 2"—with flange connections 1¼" thru 5".

HENRY—Standard equipment by leading Manufacturers, Army, Navy, Coast Guard and Maritime Commission • Stocked by Leading Jobbers

WRITE FOR CATALOGS

HENRY VALVE CO.



HENRY VALVE CO
CONTROLLING FLOW
SINCE 1914

Valves—Driers—Strainers—Control Devices and Accessories for Refrigeration, Air Conditioning and Industrial Applications

MELROSE PARK, ILL. (CHICAGO SUBURB)
CABLE: HEVALCO, MELROSE PARK, ILLINOIS
®

DIFFERENT

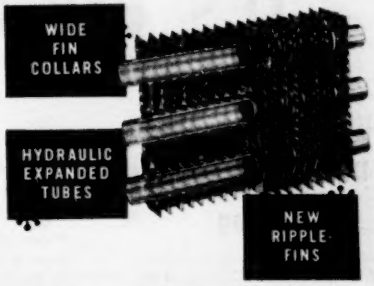
and what a difference!

McQuay's NEW RIPPLE-FIN COILS!

McQuay's new ripple-fin surface is the product of years of research aimed at producing the ultimate in heat transfer for any weight of metal. High efficiency is assured by forcing the air to follow an ever-changing direction of flow in passing through the coil. Thus the air repeatedly contacts the coil surface to give maximum contact time, maximum contact velocity, and a resultant optimum heat transfer.

With this advance in design McQuay retains the staggered tube and the McQuay rippled edge features, so well known in the industry and which contribute greatly to higher heat transfer, construction ruggedness, and eye appeal.

McQuay heating (blast) coils are available in a wide variety of styles and sizes. Hot water, cold water, brine, direct expansion, and refrigerant condensing coils are also available for practically every type of application. Write McQuay Inc., 1619 Broadway St., N.E., Minneapolis 13, Minn. Representatives in all principal cities.

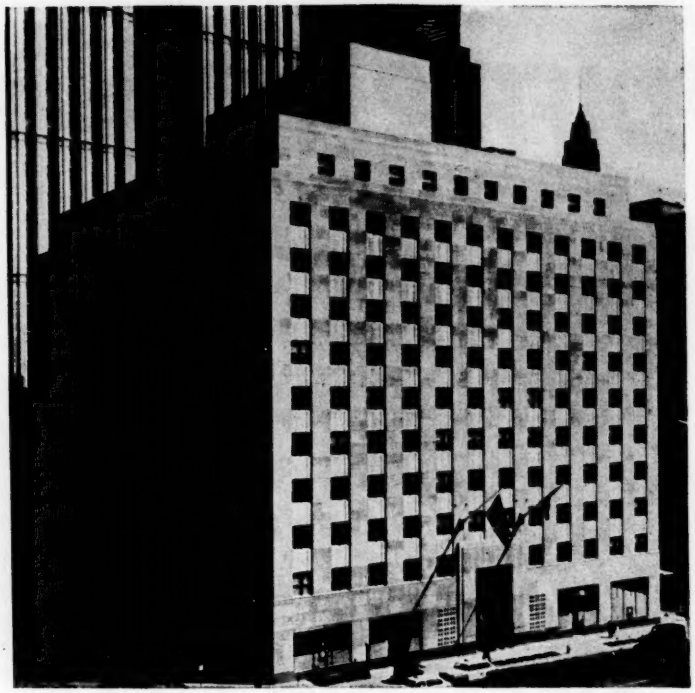


EXCLUSIVELY YOURS IN McQuay COILS!

McQuay INC.

HEATING • AIR CONDITIONING • REFRIGERATION

Dun & Bradstreet Building, 99 Church St., New York City. Architects: Reinhard, Hofmeister & Walquist. Consulting Engineers: Syska & Hennessy. Heating and Air Conditioning Contractors: Kerby Saunders, Inc. General Contractor: George A. Fuller Company.



It's air conditioned It uses STEAM

Uses for Steam in Dun & Bradstreet Building

Steam serves the heat exchanger which heats water as required for the air conditioning system, and circulating hot water for washrooms, kitchen, etc.

Steam, effectively controlled by a Webster Moderator System in two zones, assures comfort heating for the first floor stores.

Steam heats the lobby, stair towers and elevator machinery rooms and protects the roof water tank against freezing.

WEBSTER
MODERATOR
SYSTEM
OF STEAM HEATING
"Controlled by the weather"

The new 11-story Dun & Bradstreet Building, with 303,000 sq. ft. of floor area, is the largest office building erected in downtown Manhattan in 20 years.

From the designs of outstanding architects and engineers, and benefitting from a study by the Building Planning Service of the National Association of Building Owners and Managers, this fine new structure could logically be expected to incorporate the things that count most in a modern office building.

Year-round comfort is provided by 450 G-E personal weather control air conditioning units circulating filtered fresh air summer and winter. This air is tempered by water circulated through the units.

As with almost every outstanding Manhattan building, *steam* is the foundation for all the heat requirements . . . *steam*, generated at the waterside and delivered to the building through New York Steam Company's mains. The uses for steam in this air-conditioned building are detailed at left.

Circulation of steam for the Dun & Bradstreet Building is assured by installation of 122 Webster Drip Traps as well as the Webster Moderator System equipment.

Whether or not your building plans contemplate air conditioning don't overlook the fact that *steam* can be used to advantage . . . and Webster heating equipment will assure best use of that steam.

Address Dept. HV-11

WARREN WEBSTER & COMPANY

Camden 5, N. J. Representatives in Principal U. S. Cities
In Canada, Darling Brothers, Limited, Montreal

HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

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Published by

THE INDUSTRIAL PRESS
148 Lafayette Street
New York 13, N. Y.

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Subscription Rates

Subscription rates in the United States and Canada, one year, $3; two years, $5; three years, $6; in all other countries, one year, $5; two years, $9. Single copies 30 cents. Entered as second-class matter, April 18, 1925, at the Post Office, New York, N. Y., under the act of March 3, 1879.

Member, Audit Bureau of Circulations; National Business Publications.

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The Contents of HEATING AND VENTILATING are indexed monthly by Industrial Arts Index and by Engineering Index, and are microfilmed by University Microfilms, Ann Arbor, Michigan.

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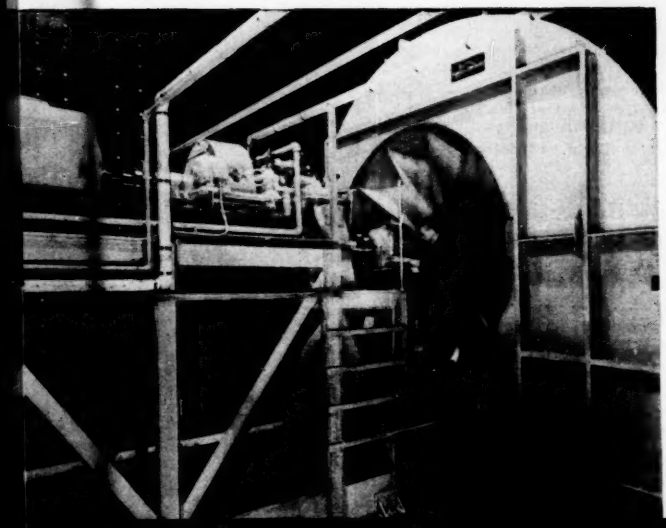
Also Publishers of
HEATING & PLUMBING EQUIPMENT NEWS
and technical books.

THIS MONTH'S COVER

Production in carbonated beverage plants is speeded and quality maintained through the use of refrigeration for improving CO_2 retention in the liquid. Sanitary conditions are important. Cover shows one of the bottling lines of the Coca-Cola Bottling Co., Indianapolis, Ind.

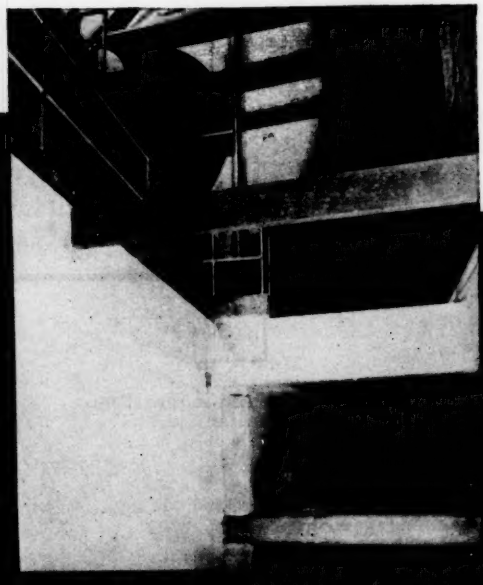
GIVE AIR A *Fast*

— as KAUFMANN'S SHOPPERS ENJOY "RESORT" CLIMATE IN ALL 13 STORIES OF PROMINENT PITTSBURGH STORE



DELIVERING 15 TONS OF AIR EVERY MINUTE!

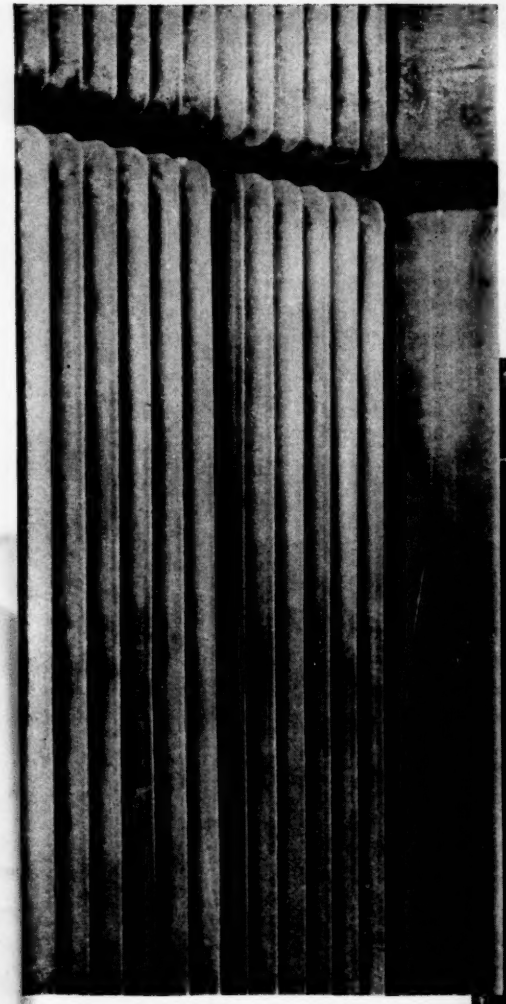
The first air conditioning installation utilizing the high duct velocity principle for large interiors. More air thru smaller ducts at faster speeds saves space and money. Designed and installed by The Carrier Corporation, this installation is already highly regarded in the department store field.



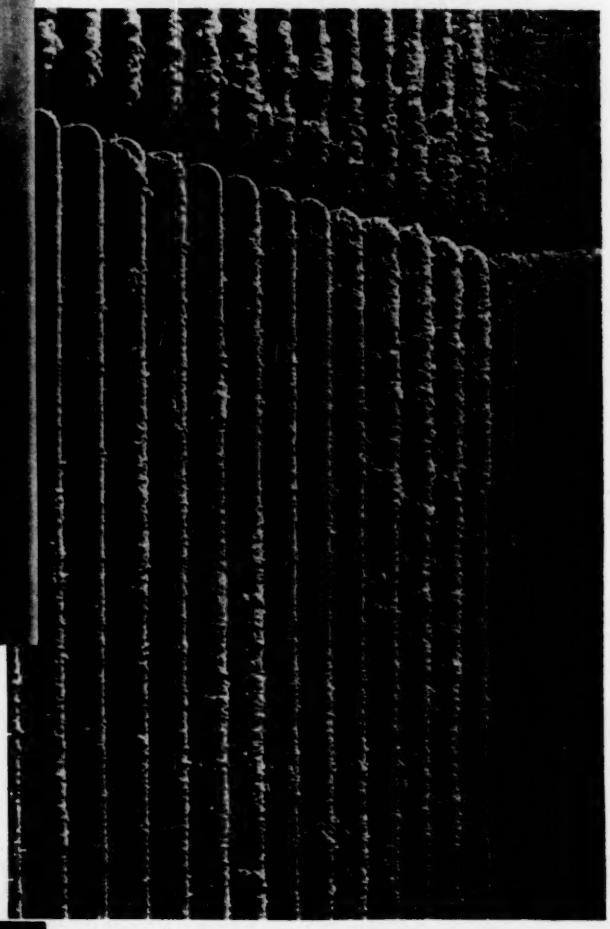
Ride

"Buffalo" CAN SOLVE YOUR AIR PROBLEM!

Precipitron®



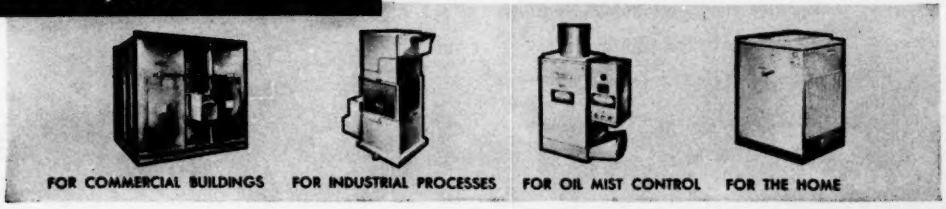
BEFORE—A close-up shows aluminum collector plates in clean PRECIPITRON cells. This is the way they appear after periodic washings, which dispose of all the trapped air-borne particles.



AFTER only 2½ weeks cleaning "normal atmospheric" air, the same plates had accumulated this much dirt. PRECIPITRON stops air-borne dirt, soot, pollen, oil mists.

ELECTRONIC *Air* CLEANING

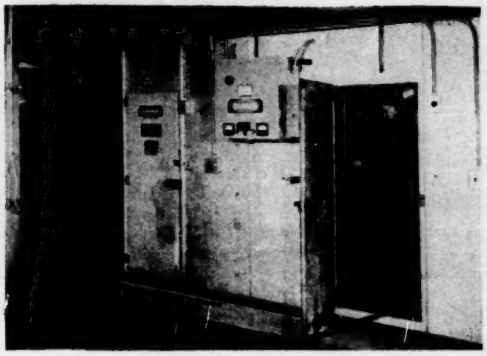
J-80227A



FOR COMMERCIAL BUILDINGS | FOR INDUSTRIAL PROCESSES | FOR OIL MIST CONTROL | FOR THE HOME

—ELECTRONIC BARRIER

Against invisible dirt



Cleaning efficiency is 90% or better at 333 fpm; 85% or better at 400 fpm. Maximum linear space required in duct is less than 8 feet.

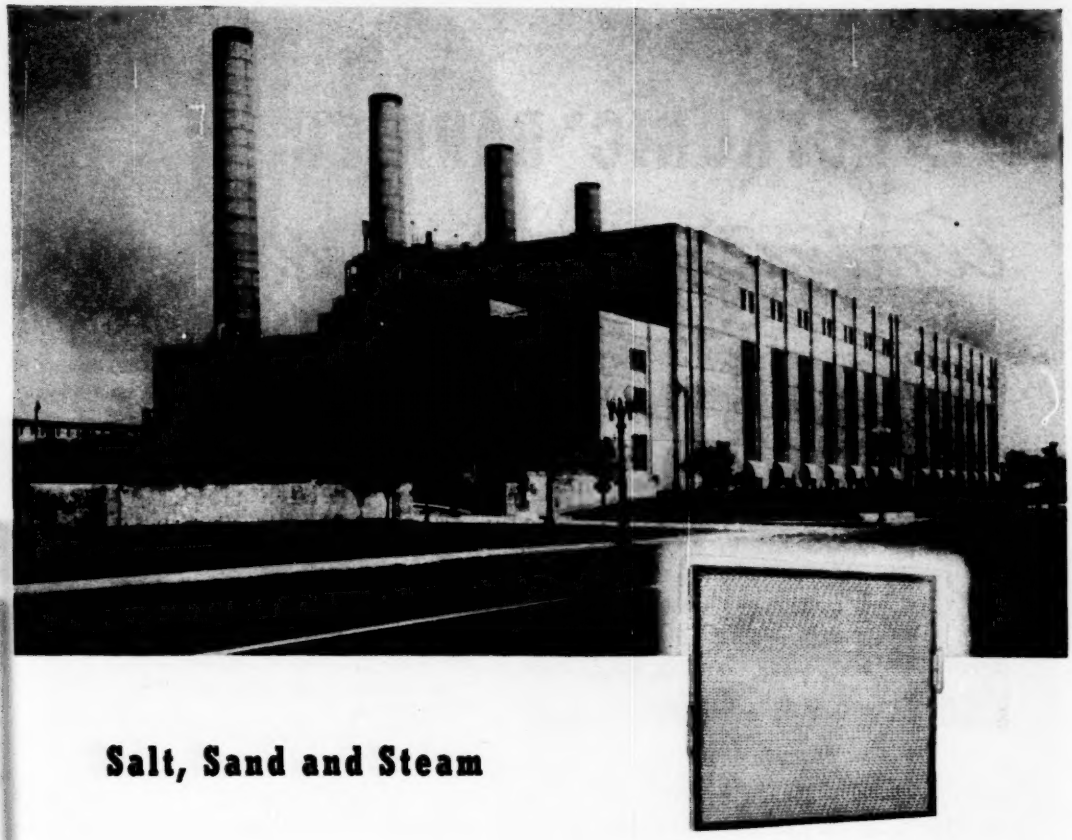
PRECIPITRON cell banks are readily accessible for thorough washing. You don't remove any part of the equipment. You don't handle dirty or messy elements. You just wash them down in place with a garden-type hose. The dirt flushes directly into the drain.

Where desired, PRECIPITRON can be furnished with Semi-Automatic Washer, or as a completely encased unit for minimum installation expense.

Air that's "fit to breathe" *isn't* clean enough. A particle of invisible, air-borne dust, no larger than 1/100,000 of an inch, can create an image on a bombsight behind which a battleship might hide. Minute corrosive particles will mar the super-finished surface of a vital engine part. Contamination by bacteria-carrying specks is dangerous in hospitals, laboratories or food processing plants. In industrial and commercial buildings, in industrial processes, in communication centers, stores, offices, and even in the home—air-borne dirt is costly everywhere.

But PRECIPITRON—the electronic air cleaner—will take *all* the dirt from the air, down to particles so tiny they can be seen only with an Ultra Microscope. If you wish to add electronic air cleaning to your present systems—or if you wish to *put air to work* with Sturtevant air handling or air conditioning apparatus incorporating electronic air cleaning—contact your local Westinghouse-Sturtevant office, or write to Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass.

YOU CAN BE SURE...IF IT'S Westinghouse



Salt, Sand and Steam

Located 150 yards from the ocean, the Southern California Edison Company's Redondo Steam Plant had a difficult air filtration problem. The blowers were located in the wall facing the ocean and the wall openings were covered by concrete hoods facing toward the ground. The corrosive salt air contained a large concentration of dust and sand, and it was necessary to handle a large volume of air — 240,000 CFM—even though the design of the hoods made filter space limited.

An installation of corrosion resistant FAR-AIR* filters, Type C4C4H was made in the form of a V bank. The installation effectively removed dust and sand while operating at the unusually high velocity of 625 FPM. FAR-AIR filters so satisfactorily solved this complex air handling problem that they have been used by this customer in several other installations.

Whether your air problem involves the elimination of dirt, grease, ink, paint, lint or almost any other airborne particles, you will find the type and size filter to meet your requirements among the many in the FAR-AIR line. Also, special filters for special applications. For complete information write to Farr Company, P.O. Box 10187, Airport Station, Los Angeles 45, California.

FAR-AIR FILTERS

*Trade Mark Reg.

FARR COMPANY *"Better by Farr"* *Manufacturing Engineers*

Los Angeles • Chicago • New York

M'f'd under license by Control Equipment Co., Ltd., Montreal, Canada

IT ALWAYS PAYS TO SPECIFY

LADISH

Controlled Quality

PIPE FITTINGS

TO MARK PROGRESS

...where flow efficiency is a vital factor

You can depend on Ladish Controlled Quality Fittings to maintain maximum flow characteristics of any piping system . . . and do it consistently year after year. For advanced Ladish engineering assures the true circularity, full effective radii and smooth inner surfaces necessary to keep turbulence and friction loss at a minimum . . . features which are doubly safeguarded by the high, inflexible standards of Ladish Controlled Quality.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • Havana • Toronto • Mexico City

today's best buy is better air!

Type N ROTO-CLONES exhausting grinding and buffing operations.

ROTO-CLONES control grinding and buffing dust!

The four Type N ROTO-CLONES* shown above are only a part of the total number installed in this large automotive parts manufacturing plant to control the difficult dust problem created by grinding and buffing operations.

The Type N ROTO-CLONE is a dynamic precipitator of the hydro-static type. It exhausts, collects and stores dust ... in the form of sludge ... within one compact, self-contained unit. High efficiency dust and fume removal is obtained by the Type N's dual washing and scrubbing action. This removes both coarse material and extreme fines from the air stream, even in excessive concentrations. Water curtains induced by air flow eliminate pumps, nozzles and all moving parts.

The Type N ROTO-CLONE maintains peak efficiency without interruptions for reconditioning or service. Also uniform air delivery assures sufficient air flow at hoods and unvarying velocities in branch pipes and main ducts at all times.

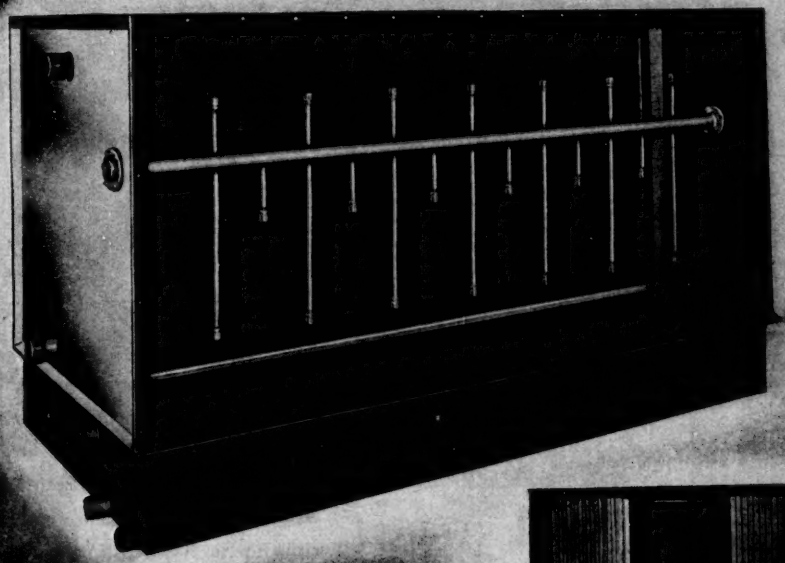
The complete line of AAF ROTO-CLONES offers a wide selection of performance and operating characteristics that will efficiently control every dust source. For the correct solution to your dust or air pollution problem call your nearby AAF representative or write direct to us.

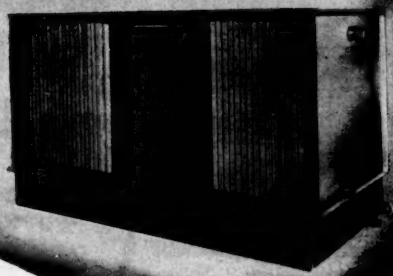
**ROTO-CLONE is the trade-mark (Reg. U.S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.*

AAF **American Air Filter**
COMPANY, INC.

294 Central Avenue, Louisville 8, Kentucky • In Canada: Darling Bros., Ltd., Montreal, P. Q.

KENNARD Engineered





56 Sizes

Sprayed Coil Dehumidifiers

6 Sq. Ft. to 81 Sq. Ft.—Air Volumes up to 48,600 CFM

This large range of sizes makes Kennard Sprayed Coil Dehumidifiers adaptable to any requirement of space or capacity for year-round air conditioning—cooling and dehumidifying in summer, humidifying in winter, evaporative cooling in spring and fall, and at all times washed and cleaned air.

Features of Construction—Sump pan, eliminators, casing and coil frames all galvanized construction—bolted together construction of casing with Silicon Bronze or Stainless Steel nuts and bolts—complete with recirculated spray water piping, brass water make-up valve and spray nozzles. Coils available for either Direct Expansion or Water—fabricated with copper tubes and fins. Pump and Motor Assembly is optionally available.

Representatives in Principal Cities

Write for name of nearest representative and complete information on Air Conditioning Blower Units—Finned Coils — Evaporative Condensers — Cooling Towers.

KENNARD CORPORATION · 1823 S. HANLEY ROAD ST. LOUIS 17, MO., U.S.A.

Peak Pump Performance

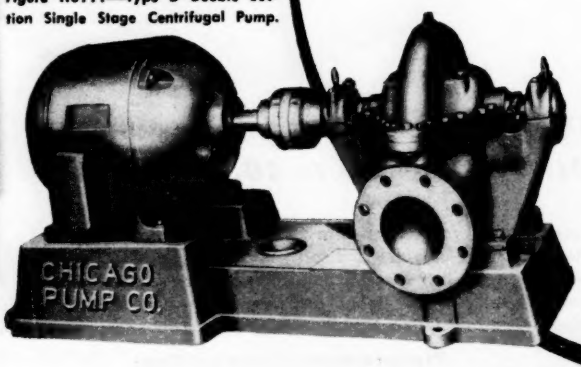
ALWAYS FLOWS FROM CHICAGO TYPE N and TYPE D CENTRIFUGALS

Figure N8927—Type N Close Coupled Pump.

Type N Close Coupled Pump

Compact and sturdy. Designed to handle the toughest pumping jobs efficiently and in the least possible space. A precision built mechanical seal on the shaft requires no adjustment and eliminates dripping. Available in seven frame sizes with capacities up to 500 G.P.M. and heads up to 215 ft. Write for Bulletin 108.

Figure H8111—Type D Double Suction Single Stage Centrifugal Pump.



Type D Double Suction Single Stage Pump

For house pump, fire and booster service this pump combines the best materials available with the skilled craftsmanship found in every Chicago pump. Available in thirteen frame sizes for capacities up to 1900 G.P.M. and heads up to 530 ft. Write for Bulletin 101.

CHICAGO PUMP COMPANY

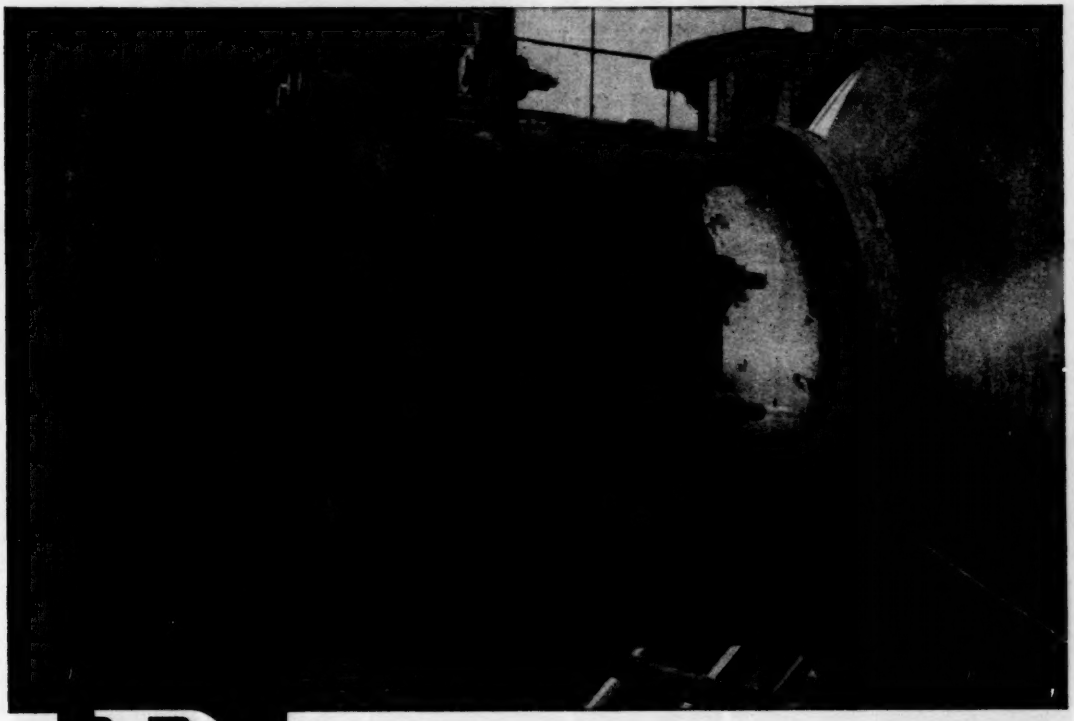
BUILDING and INDUSTRIAL DIVISION

2300 WOLFRAM STREET

Condo-Vac, Sure Return. AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems

CHICAGO 18, ILLINOIS

Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use.



Rx for steel mill gas pains...

ADSCO Expansion Joints
Just What the Doctor Ordered

In most coke oven gas mains, expansion is absorbed by a series of unwieldy disc diaphragms fabricated directly into the lines. However, these installations often prove unsatisfactory because of limited contraction, ruptures, shutdowns for repair, etc.

Last year, after detailed study, a large steel mill in the East selected ADSCO Piston-Ring Expansion Joints. Eight 36″ and five 24″ slip-type joints, with 8″ traverse and special piston rings, were installed in lines carrying coke oven gas at 200 F. and 25 psi.

This installation proved so successful and so satisfactory in service that more ADSCO Piston-Ring Expansion Joints are now on order for similar applications.

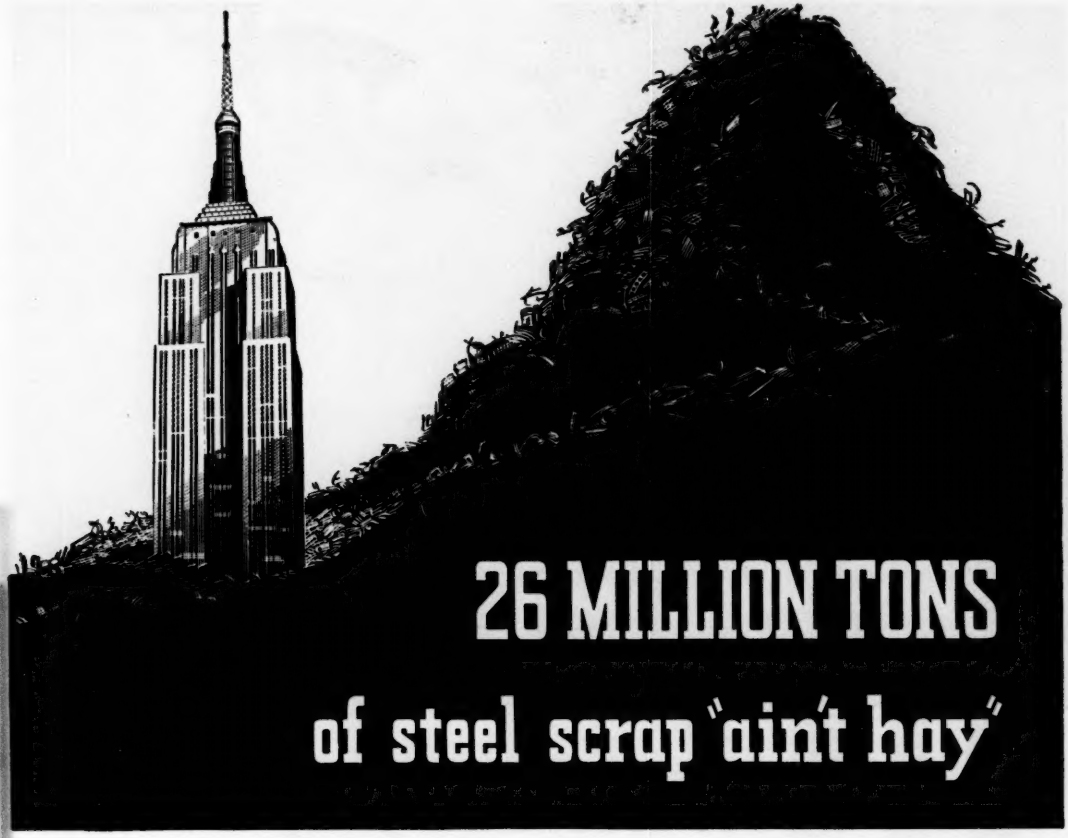
For 75 years, ADSCO has prescribed the *best* remedy for *every* pipe-line expansion problem. ADSCO made the first expansion joint . . . ADSCO now makes the most complete line of expansion joints available from any manufacturer. When *your* problem is pipe-line expansion, why not profit by the experience of hundreds of other companies? Consult ADSCO.

ADSCO Piston-Ring Expansion Joints can be packed under full line pressure. They are made in a complete range of sizes for pressures to 400 psi or greater and temperatures to 750 F. or higher. For further information, write for Bulletin V-35-15.

THE MOST COMPLETE LINE

In addition to more than 6500 standard models of slip-type joints, ADSCO makes complete lines of *Corruflex* Packless Corrugated Expansion Joints and Variator diaphragm-type Expansion Joints.

AMERICAN DISTRICT STEAM COMPANY, INC. • North Tonawanda, N.Y.



26 MILLION TONS

of steel scrap "ain't hay"

IT took 57,000 tons of steel to build the Empire State Building in New York. That's about one-tenth of one percent of the tonnage of scrap required to produce the new steel demanded for America's defense and civilian needs this year.

Half of this scrap is produced by the steel mills themselves. The other half - approximately 26 million tons - must be supplied by the public. That tremendous tonnage is the equivalent of 461 Empire State Buildings - over 1400 carloads of scrap every day of the year.

Right now there is a scrap shortage. It threatens to interfere with steel production. So we appeal to you, as a user of steel and steel products, to do all you can personally to help collect scrap.

Somewhere in your place of business - and even at home - there are things that can be scrapped - worn-out or obsolete machines, pipe, boilers, tools, structural parts, etc., that you'll never use again in their present form. Turn them in through regular channels. Call the nearest dealer and start your scrap on its way to the steel mills - to help America reach its production goal of 105 million tons of new steel in 1951. It is this team-work that will help us win the victory again.

YOUR SCRAP Y YOUNGSTOWN IS NEEDED

The Youngstown Sheet and Tube Company

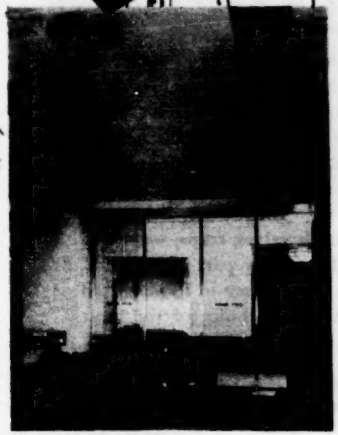
General Offices--Youngstown 1, Ohio

Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

Aerofuse IN DETROIT



PENOBSCOT BUILDING

Other typical Aerofuse installations in the Detroit area

CHRYSLER CORPORATION

GENERAL MOTORS TECHNOLOGICAL CENTER

HOLLEY CARBURETOR CO.

BRIGGS BUILDING, BIRMINGHAM

JACOBSON'S DEPARTMENT STORE, BIRMINGHAM

In the city that symbolizes efficiency, it is not surprising to find that important air conditioning jobs are Aerofuse jobs. In many of Detroit's great automotive plants, modern office buildings, fashionable stores — where air conditioning has become an essential part of comfort — Aerofuse Diffusers have been specified for installation *at the vital point of air delivery.*

From experience, the engineers, architects and contractors — the men responsible for the performance and appearance of these jobs — know that Aerofuse Diffusers are engineered to meet the most rigid requirements of air distribution . . . are styled to harmonize with modern interior design.

For complete information about the wide range of Aerofuse types and sizes, write for Catalog 104.

TUTTLE & BAILEY inc

NEW BRITAIN, CONNECTICUT

ENGINEERED PRODUCTS FOR AIR CONDITIONING, HEATING AND VENTILATING

117DD1

Permanent Valves and Traps for a Permanent Building . . .

Federal Office Building
NASHVILLE, TENNESSEE

Architects — Engineers:
Marr & Holman, Nashville

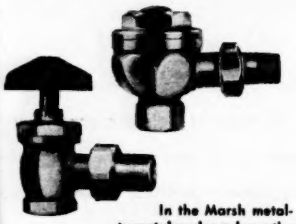
Plumbing and Air Conditioning Contractors:
J. M. Gallagher Company, Nashville

Impressive even in the vast building program of the Public Buildings Administration is this big Federal Office Building at Nashville, Tenn.

Buildings like this are built to function faultlessly, with a minimum maintenance, for a long, long time to come. This is also the distinguishing characteristic of Marsh Heating Specialties. So the choice of Marsh Valves and Traps for this massive structure is entirely logical.

At the right of the illustration you see a part of the stately Nashville Post Office. Erected in the late thirties and also equipped with Marsh Heating Specialties, it stands as another example of a permanent building provided with permanent heating equipment.

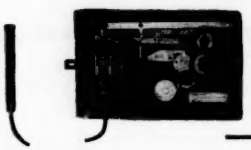
Indeed this respect for Marsh quality is demonstrated on a nation-wide scale in the selection and specification of Marsh valves, traps, vents and controls for finer buildings, large and small, in every part of America. Use Marsh equipment on your next job and you will see in its advanced design and trouble-free service why it is the first choice of the most discriminating heating men.



In the Marsh metal-to-metal seal you have the finest packless valve construction and in the Marsh radiator trap you have the most efficient team-mate for it. This combination was widely used in the Nashville Federal Office Building.

This Marsh float and thermostatic trap is typical of a wide line of Marsh traps for all services. Many are installed at Nashville.

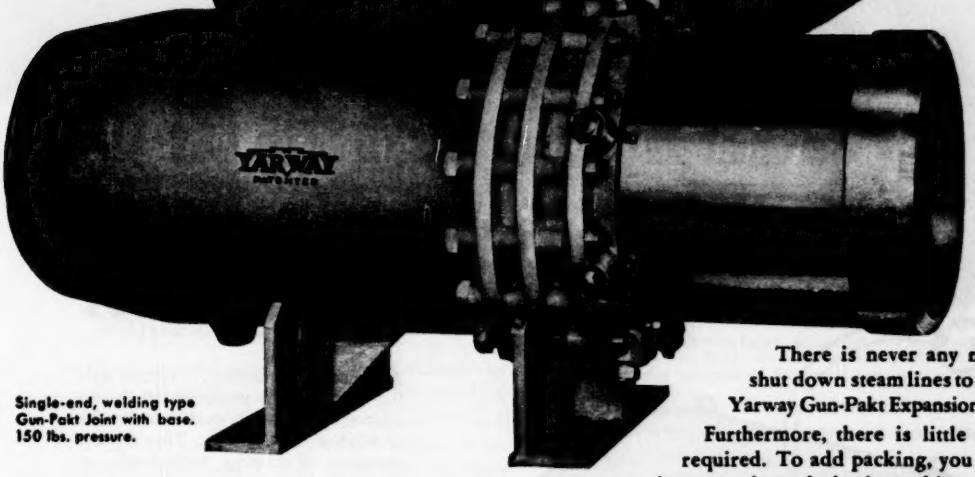
MARSH HEATING EQUIPMENT CO. *Sales affiliate of Jas. P. Marsh Corporation*
Dept. U, Skokie, Ill.



BIG FUEL SAVINGS — WITH HEAT REGULATION IN STEP WITH THE WEATHER.
Maximum comfort with minimum heating costs . . . that is what the Marsh-Tritrol accomplishes by controlling heat in step with outside weather. Ask for facts.

MARSH *Heating Specialties* **SINCE 1865**

THIS EXPANSION JOINT IS SERVICED UNDER FULL STEAM PRESSURE



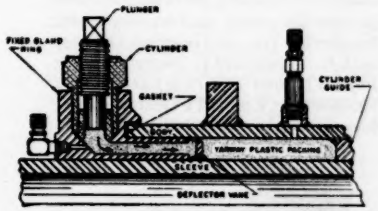
Single-end, welding type Gun-Pakt Joint with base. 150 lbs. pressure.

There is never any need to shut down steam lines to service Yarway Gun-Pakt Expansion Joints. Furthermore, there is little service required. To add packing, you simply insert a plug of plastic packing, turn a wrench, and the job's done! Special Alemite fittings provide for proper lubrication.

Maintenance costs are trifling. One large user reports 65 cents per year per joint. Others claim less than that.

Gun-Pakt Joints are available with single or double-ends, welding or flanged types, in sizes from 2" to 30", with traverses from 4" to 24", and for pressures to 400 psi.

For the full Gun-Pakt story, write for Yarway Bulletin EJ-1912.

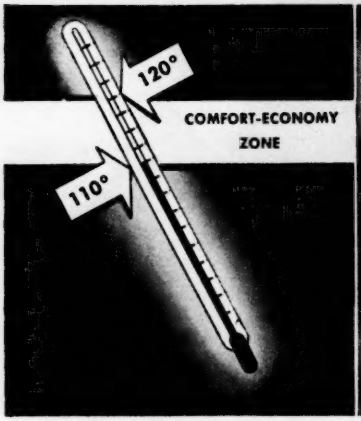


Close-up of cross-section showing detail of Gun-Pakt feature.

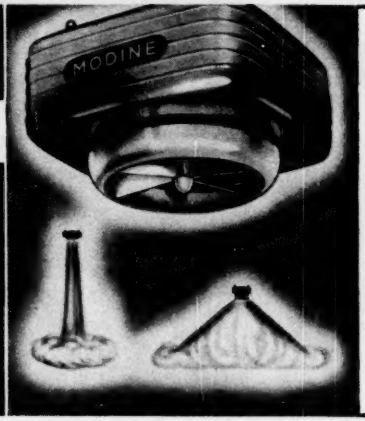
YARNALL-WARING COMPANY
104 Mermaid Avenue, Philadelphia 18, Pa.
Branch Offices in Principal Cities

YARWAY **GUN-PAKT EXPANSION JOINT**

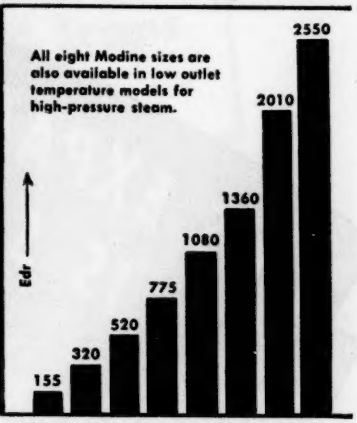
Three of many outstanding features that account for the Modine quality reputation



Discharge air temperatures of 110° to 120° F. are correctly related to air-velocities — assure perfect heating comfort plus lower fuel costs.



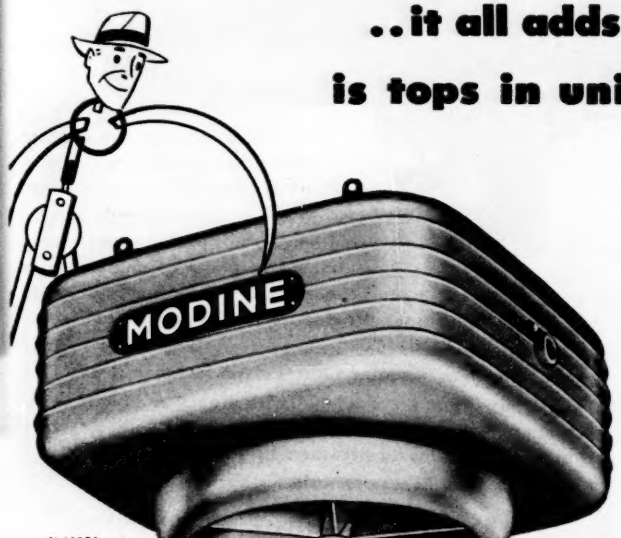
Versatile control of air delivery is provided by Cone-Jet, Truncone or Louvre deflectors. You can choose the *right* one for your job at no extra cost.



Big Modine Vertical Units for big defense plants eliminate expensive ductwork, retain the flexibility necessary for subsequent changes in plant layout.

COMPARE

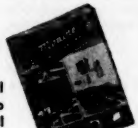
..it all adds up to this..Modine is tops in unit heater values



U-1112A

Vertical delivery model shown here. Also available in Horizontal and Power-Throw types.

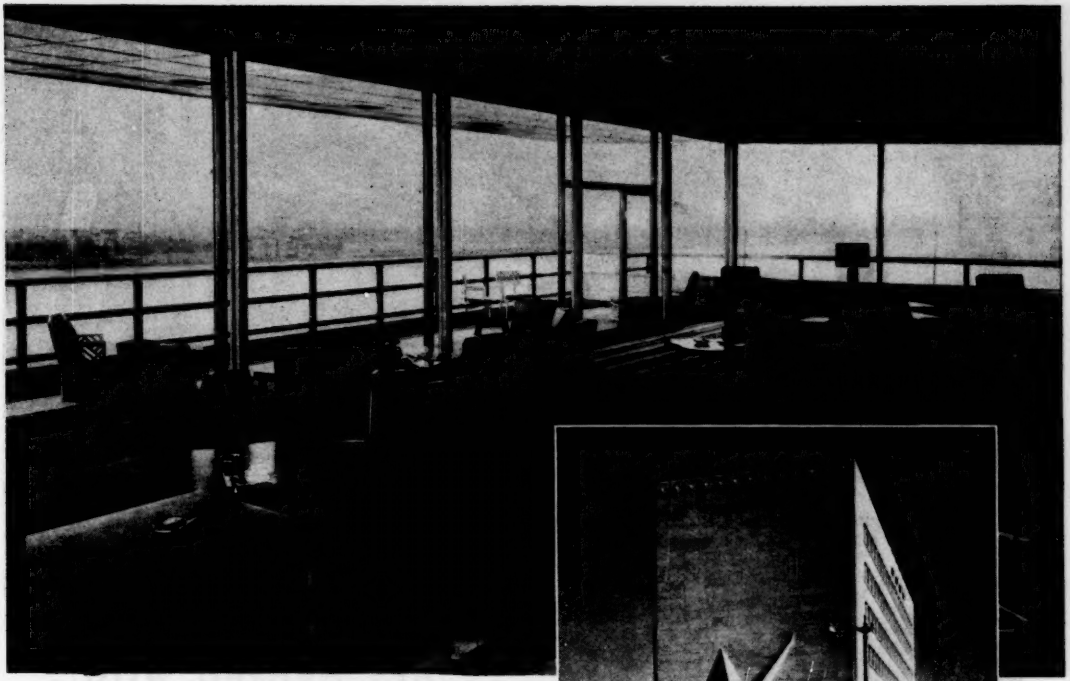
Advanced engineering . . . superb styling . . . highest grade materials and craftsmanship — all quality hallmarks of Modine Unit Heaters. They're your assurance of *heating performance at its best* — high fuel economy . . . years of trouble-free service. Built to a standard of excellence — Modine is the choice for unfailing dependability, lower operating and maintenance costs. So whether you need Vertical Delivery models (illustrated), Horizontals or Power-Throws — *compare first!* Modine Mfg. Co., 1511 Dekoven Ave., Racine, Wis.

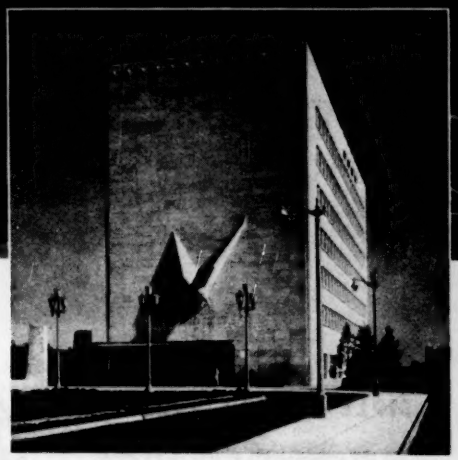


Write for Bulletin 149-A, "Modine Unit Heating." Or contact your Modine representative listed in the classified section of your phone book.

Engineers rate Modine the standard of excellence

Modine UNIT HEATERS





Simply beautiful

kno·draft
adjustable air diffusers

In their beautiful simplicity of line, Kno-Draft Adjustable Air Diffusers are grace notes for any decorative theme. But unless you just happened to look ceilingward, you might not ever notice them in the modern lounge above. Nor would they be more obtrusive in period surroundings.

Certainly, Kno-Draft Adjustable Air Diffusers will never call attention to themselves by discomforting the occupants of any room. All that their name implies, Kno-Draft Adjustable Air Diffusers circulate air gently and *without draft* . . . keep temperature uniform throughout the conditioned area. Air volume and flow pattern are adjustable *after* installation

Lounge and exterior, Veterans Memorial Building, Detroit, Mich.
Architects and Engineers: Harley, Ellington & Day, Inc., Detroit, Mich.
General Contractors: Kuhne-Simmons Co., Inc., Detroit
Air Conditioning Contractors: American Refrigerating Co., Detroit

. . . thus simplifying the engineering of the job as well as providing flexible control to meet both present and future conditions.

You'll find Kno-Draft Adjustable Air Diffusers in many of America's notable and architecturally significant buildings. Whatever the air conditioning requirements, there are types and sizes to meet them. Write us for detailed information.

KNO-DRAFT DATA BOOK: Complete specifications, engineering and installation data on Kno-Draft *Adjustable* Air Diffusers. To get your copy, simply fill in and mail the coupon. No obligation, of course.

TRADE MARK "KNO-DRAFT" REG. U. S. PAT. OFF.

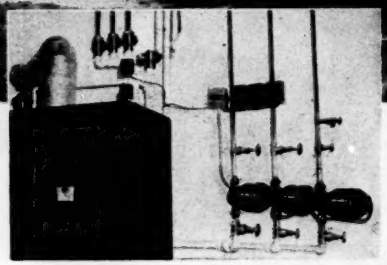
W. B. CONNOR ENGINEERING CORP.
Danbury, Connecticut
Air Diffusion • Air Purification • Air Recovery
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

W. B. CONNOR ENGINEERING CORP.
Dept. J-111, Danbury, Connecticut

Please send me, without obligation, my copy of the Kno-Draft Air Diffuser Data Book.

Name .....
Position .....
Company .....
Street .....
City ..... **Zone** ..... **State** .....

Today's most modern homes . . .



A SIMPLE ZONED SYSTEM

Notice the compactness of this three-zone Flow Control System and the inexpensive units used. Just a Circulator, a Flow Control Valve and a No. 201 Radiant Heat Control in each zone. There are no costly motorized valves no complicated devices to give trouble. Temperature in each zone is maintained automatically.

. . . are heated with THRUSH *forced circulating* HOT WATER HEAT

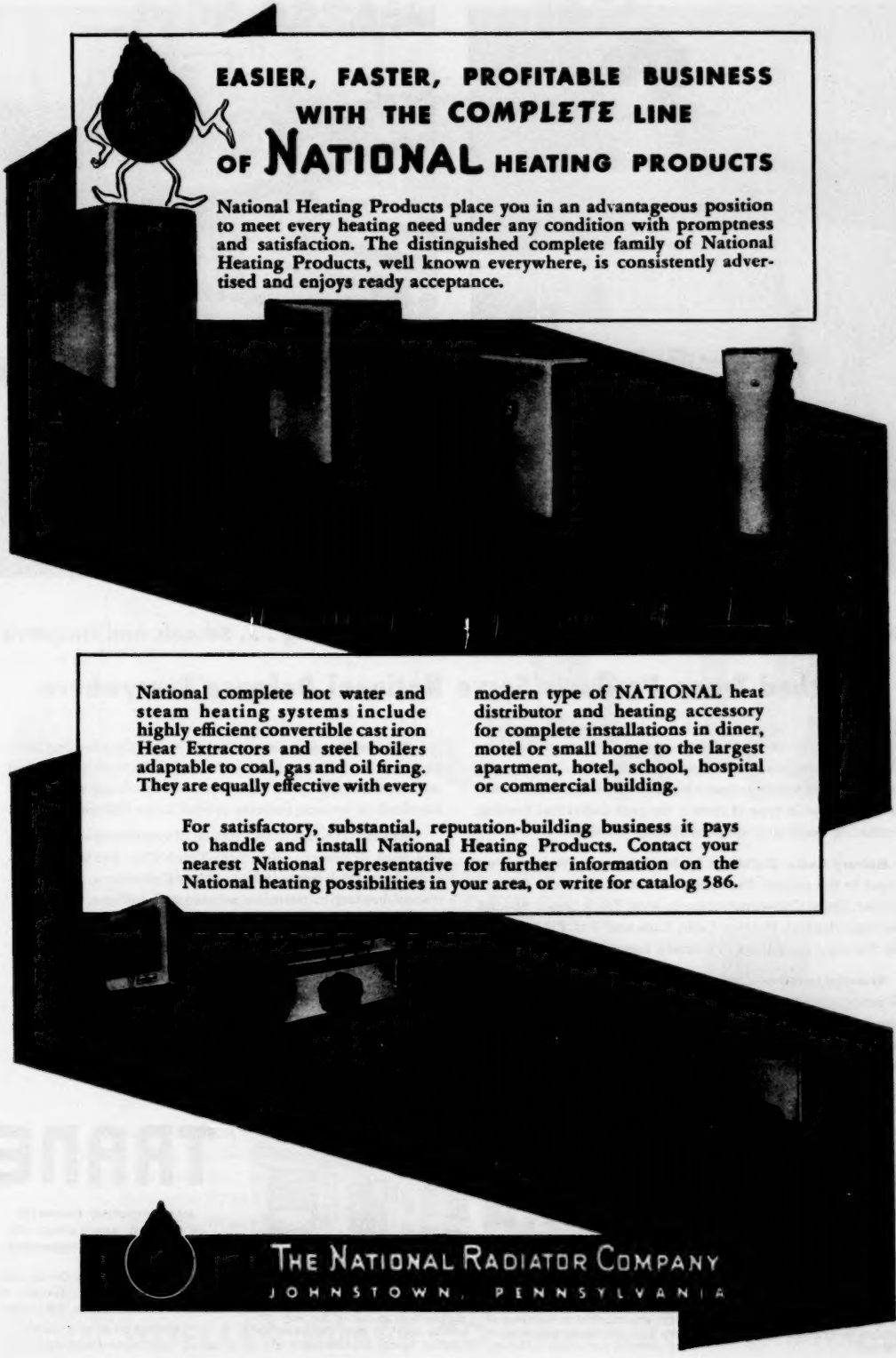
HERE'S a beautiful new home heated economically with forced circulating hot water, with radiant coils in the ceiling providing completely automatic radiant heat in any weather. Thrush Flow Control System of Forced Circulating Hot Water Heat assures highest efficiency . . . uniform temperatures in every room . . . with no overheating. Room temperature is controlled within a fraction of a degree separately in each of the three zones. This is the heating plant your customers want. See your wholesaler today or write Dept. D-11 for more information.

Horizontal Water Circulator

Vertical Flow Control Valve

Ask for folder on Thrush Forced Circulating Flow Control System of Hot Water Heating.

H. A. THRUSH AND COMPANY PERU, INDIANA



EASIER, FASTER, PROFITABLE BUSINESS WITH THE COMPLETE LINE OF NATIONAL HEATING PRODUCTS

National Heating Products place you in an advantageous position to meet every heating need under any condition with promptness and satisfaction. The distinguished complete family of National Heating Products, well known everywhere, is consistently advertised and enjoys ready acceptance.

National complete hot water and steam heating systems include highly efficient convertible cast iron Heat Extractors and steel boilers adaptable to coal, gas and oil firing. They are equally effective with every modern type of NATIONAL heat distributor and heating accessory for complete installations in diner, motel or small home to the largest apartment, hotel, school, hospital or commercial building.

For satisfactory, substantial, reputation-building business it pays to handle and install National Heating Products. Contact your nearest National representative for further information on the National heating possibilities in your area, or write for catalog 586.

THE NATIONAL RADIATOR COMPANY
JOHNSTOWN, PENNSYLVANIA

Military Bases . . . Essential Industries . . . Defense Housing . . . Schools and Hospitals

Matched Trane Products Serve National Defense Everywhere

Matched Trane Products are completely coordinated for selection, installation and operation together. An infinite number of combinations can be easily fitted together to form the most suitable type of system for each individual heating, ventilating, cooling or air conditioning problem.

Military Bases—Buildings by the thousands from smallest chapel to the mighty Pentagon, need heating in one form or another. Trane Convectors team up with Trane Steam Specialties, Unit Heaters, Heating Coils, Fans and Wall-Fin to create just the right conditions in military bases everywhere.

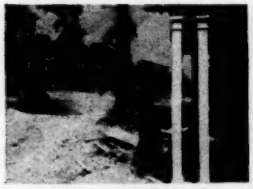
Essential Industry—Critical dimensions and critical worker efficiency have to be kept under close climate control in the manufacture of munitions. Trane Reciprocating Compressors combine with Trane Climate Changers to hold close tolerances and make men efficient.

Defense Housing—Easy-to-install economical heating units required for multiroom projects. Trane Convectors matched with Trane Hot Water Products provide sparkling warmth for hundreds of housing projects so vital to the defense program.

Schools—The right combination of ventilating and heating is a must in modern education—Trane Unit Ventilators provide clean, fresh tempered air—Trane Convectors, the supplemental heating in countless schools and colleges.

Hospitals—Correct humidity and temperatures are essential in the hospital operating room to speed the surgeon and protect the patient. The new Trane Operating Room Air Conditioner fits in conveniently to furnish the exact conditions required.

Whatever your heating, ventilating, cooling or air conditioning problem is, look for the answer in the Trane line.



This housing project contains almost a thousand Trane Convectors in addition to Trane Trap Valves and Pumps.

The Merle Abbot School—so successful was the first installation of Trane Unit Ventilators that more were ordered for a new addition.

Trane Air Conditioning equipment tucked into an out-of-the-way corner is used to cool the twin operating rooms in this hospital.

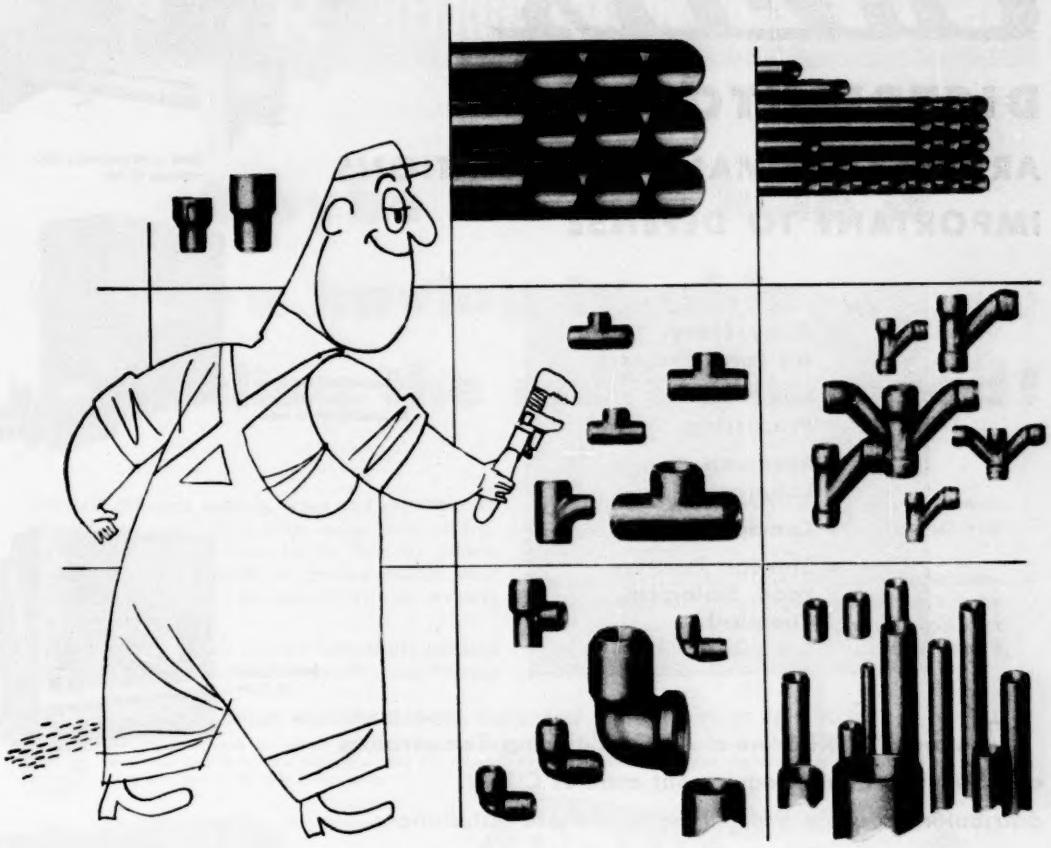
TRANE

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division . . . Scranton, Pa.
Trane Company of Canada, Ltd., Toronto

OFFICES IN 80 U. S. AND 14 CANADIAN CITIES

PIPE DREAM . . . 1951



Since the available supply of copper for non-defense work has become so limited, there just isn't a great deal we, or anyone else can do, these days, to fill your wants for MUELLER BRASS STREAMLINE copper tubing. We can say only this, for certain . . .

We can fill your orders for most STREAMLINE fittings.

We will not cut down quality of STREAMLINE fittings or tube regardless of material shortages.

We will do our best to help you solve any installation problem you ask us about.

As soon as copper becomes more plentiful we will be the first to see that you get the tubing and fittings you want. You can then make the kind of home, commercial and industrial STREAMLINE copper installations you know are the finest money can buy.

See your jobber for further information or write for catalogs S-351 and W-251 describing our complete line of STREAMLINE *wrought copper and cast bronze fittings.*

MUELLER BRASS CO. STREAMLINE PRODUCTS

MUELLER BRASS CO. PORT HURON 2, MICHIGAN

Curtis

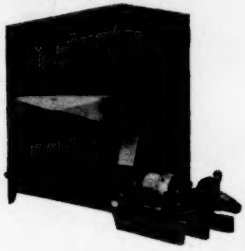
DISTRIBUTORS

ARE MAKING MANY INSTALLATIONS IMPORTANT TO DEFENSE

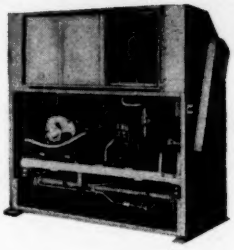
Water-cooled Condensing Units —through 40 tons

in

- Army, Navy, Air Force Projects,
- Industrial Processing,
- Research Laboratories,
- Commissaries,
- Storage Plants—Food, Biological, Chemical



Evaporative Condensers, Cooling Towers and Air Handling Units to match



Central Type— 10-15 ton

The broad CURTIS line of Air Conditioning, Temperature and Humidity Control equipment enables CURTIS distributors to *quote* and *get* many of these installations.

With Condensing Units through 40 HP . . . Evaporative Condensers . . . Cooling Towers and Air Handling Units to match, CURTIS distributors can handle *more jobs*, make *greater profits*.

Package Type— 2-4-6-8 ton

Some Franchises are Open. Pin this coupon to letterhead and mail for complete information

Curtis REFRIGERATION AIR CONDITIONING COMMERCIAL

Curtis Refrigerating Machine Division
of Curtis Manufacturing Company
1999 Kienlen Avenue • St. Louis 20, Missouri

I am interested in Curtis Franchise. Send complete details.

Name.....

Street.....

City.....Zone....State.....

R51-8

97 Years of Successful Manufacturing Experience is "Built-In" Curtis Equipment

BRUNNER SINCE 1906 **REFRIGERATION** helps you serve better

Maybe we can help if you are having trouble finding the units you need!

With 69 different models, types and capacities of refrigeration condensing units being built on regular production schedules in the Brunner plants, you have more assurance of getting exactly what you need, and when you need it, without wasting time hunting.

What's more, we offer you the help of experienced factory field men backed by an able engineering staff who have encountered and answered just about every kind of refrigeration or air conditioning problem imaginable.

With so much to offer folks engaged in the commercial refrigeration business, it just doesn't make sense to deprive yourself of the advantages that come with recommending and installing Brunner's as a regular habit.

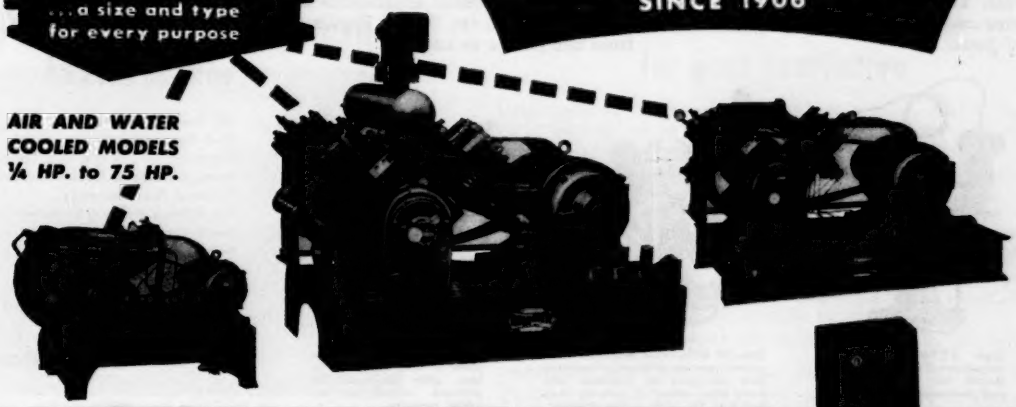
BRUNNER MANUFACTURING COMPANY, UTICA 1, N. Y., U. S. A.

P.S. *As a business man you should talk to a Brunner factory sales engineer. It costs nothing to listen, and you may discover that you have been missing a good bet. Your name and address written on the margin of this ad and mailed to us at Utica is all that is necessary.*

REFRIGERATION CONDENSING UNITS ...a size and type for every purpose

BRUNNER SINCE 1906

AIR AND WATER COOLED MODELS ¼ HP. to 75 HP.



BRUNNER SINCE 1906

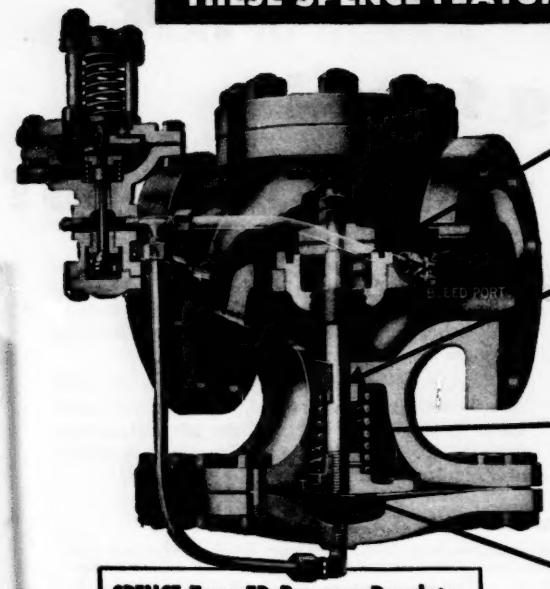
AIR CONDITIONING

Self Contained Units in 4 sizes: 3-5-7½ and 10 HP.
Remote Installation Types from 3 to 75 HP.

HERE'S PROOF

You Can Cut Costs of Pressure and Temperature Control

THESE SPENCE FEATURES SHOW YOU HOW



SPENCE Type ED Pressure Regulator

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. *More than twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

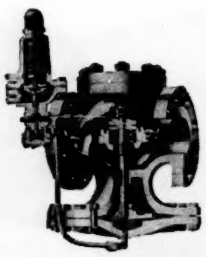
SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

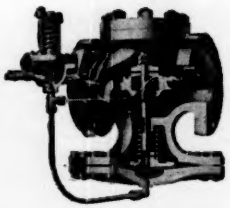
YOU BENEFIT by these and many other Spence features that assure *accurate, dependable* regulation year after year. That means *less down-time, less time and money wasted on replacement of parts.*

Spence Pressure and Temperature Regulators are built in sizes from *¼" to 12"* for service with *air, steam, water, oil or gas.* Only minor adjustments are needed to switch any Spence Regulator from one service to another.

Type ET150 Temperature Regulator—Taps in performance for both storage and instantaneous heaters.



Type EN Differential Regulator—Accurately controls differential between fluid delivered by regulator and some other source of pressure connected to the pilot spring chamber.



Type EQ Back Pressure Regulator — Completely packless, pilot operated for accurate control of the initial pressure.

These Companies Have Profited with SPENCE!

The Springs Cotton Mills
Ford Motor Company
Pennsylvania Power & Light Company
Jones & Laughlin Steel Corporation
National Tube Company
The Atlantic Refining Company
Great Lakes Steel Corporation
Todd Shipyards Corporation
Land O'Lakes Creameries, Inc.
General Electric Company
R. J. Reynolds Tobacco Company
Ohio Edison Company

and thousands of others

SPENCE ENGINEERING COMPANY INC.
WALDEN, NEW YORK

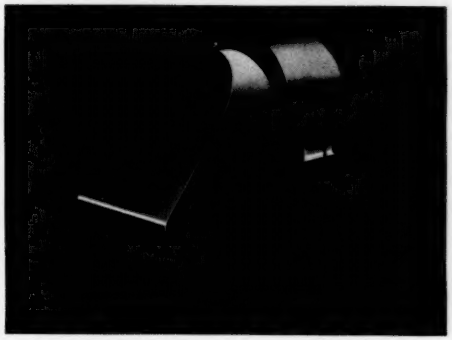
Spence

American Blower—a time-honored name in air handling

There's a big difference in quality, design, quietness, operating costs and efficiency between American Blower and ordinary air handling equipment. It pays to look before you buy! Comparative tests by buyers have thoroughly proved the superiority of American Blower Air Handling Equipment.

In Boston, as in other cities, American Blower Air Handling Products have been serving commerce, industry and public utilities for over half a century. For air handling data in the Boston area, call American Blower—Liberty 2-8427. In other areas, consult your phone book.

Product of the month



American Blower Utility Sets are available in a wide range of sizes and capacities. Write for Bulletin 2814.

American Blower Utility Sets for good ventilation

Present-day standards call for good ventilation in schools, apartment houses, restaurants, stores and hospitals as well as in industrial plants.

So we'd like to suggest that now is a good time to investigate the advantages of American Blower Utility Sets.

The Utility Set is ideal for general ventilation where duct systems are required. It can be used as a supply or exhaust fan and is equipped with Aileron Control for regulation of air flow.

Utility Sets are built of the finest materials by experienced craftsmen and are carefully tested and rated. They are available as standard packaged units all ready for you to install.

Ask the nearest American Blower Branch Office for full data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

YOUR BEST BUY AMERICAN BLOWER AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

But your rooms seem larger!

Yes, Radiant Heating makes rooms larger

Americans like "room to stretch!" So, no matter how modest a home, or how limited by budgetary considerations, our *desire* for "elbow room" and a feeling of spaciousness is as strong today as it ever was.

The chances of getting it are good, too, thanks to the ingenuity of modern architects, builders, and manufacturers, who have incorporated dozens of space-saving and space-making ideas into modern home design.

One of these, radiant panel heating, in addition to providing healthful automatic heat, actually *makes* interiors *larger* by installation of the heating units within floors, walls and ceilings.

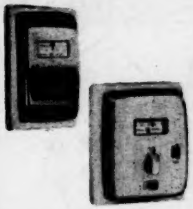
Steel pipe is first choice for this modern "invisible heat." For steel pipe has all the qualities of formability, weldability, durability, and economy required for successful radiant panel systems. Proved in conventional hot water and steam systems for more than 60 years, steel pipe brings to this latest method of heating, an established, time-honored quality of pipe service fundamental to efficient operation.

Write for a copy. A free 48-page color booklet "Radiant Panel Heating with Steel Pipe"

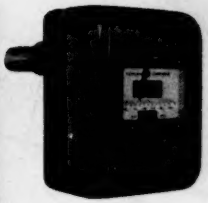
Steel Pipe is First Choice

COMMITTEE ON STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
350 Fifth Avenue, New York 1, N.Y.

B-55 G Governor Type Valve



T-70 and T-70T Thermostats



L-32 Immersion Thermostat

5B Interval, On-Off Time Switch

for better HEAT CONTROL check GENERAL CONTROLS

Whatever the control problem . . . whether it's product control . . . or process control . . . in any application where a higher level of operating performance is the goal . . . automatic controls more often than not form the solution . . . and in the field of automatic controls . . . there's certain to be a General Control that can be relied upon to do a better job. That's why more and more of the leaders in American Industry are joining in the big swing to General Controls . . . that's why there are so many new voices in the rising chant that,

"for the best in automatic control, it's General Controls."

A-100 Thermopilot Relay

R-99 Stack Switch

L-54 Solid Charge Combination Fan and Limit Control

Hydramotor G 1-7

T-30 Package Set

BX-69 Package Set

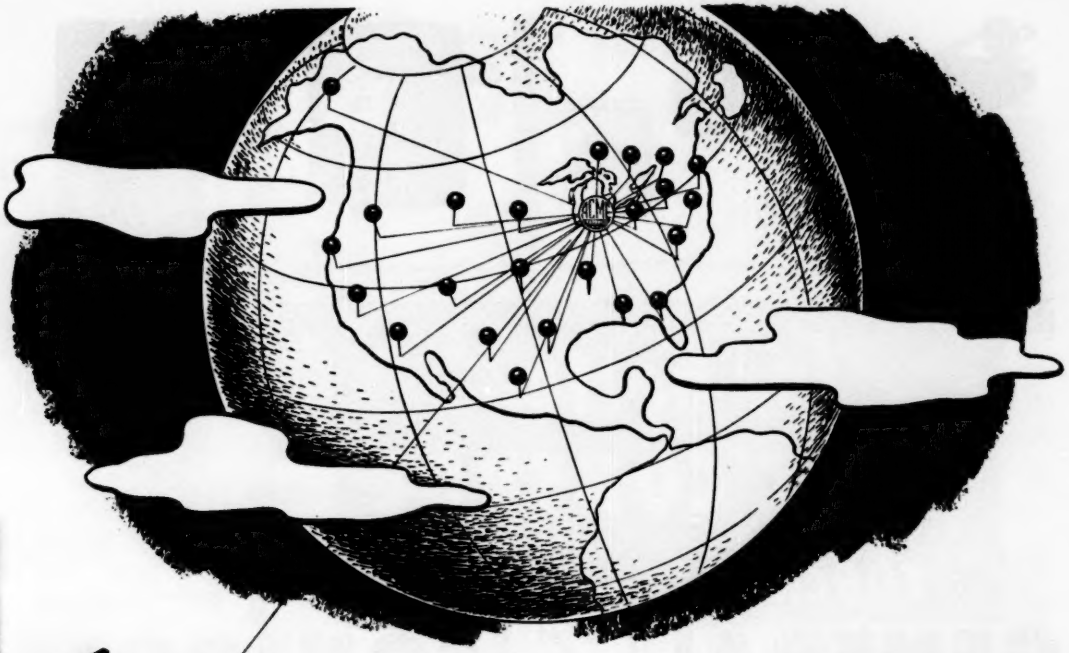
SIMPLIFIED TWO WIRE CONTROLS ARE BETTER

GENERAL CONTROLS

801 ALLEN AVENUE GLENDALE 1, CALIFORNIA

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls

FACTORY BRANCHES: Baltimore 5, Birmingham 3, Boston 16, Buffalo 3, Chicago 5, Cleveland 15, Columbus 15, Dallas 2, Denver 4, Detroit 21, El Paso, Glendale 1, Houston 6, Indianapolis 4, Kansas City 2, Milwaukee 3, Minneapolis 2, Newark 6, New Orleans, New York 17, Omaha 2, Philadelphia 23, Pittsburgh 22, Salt Lake City 4, St. Louis 3, San Francisco 7, Seattle 1, Tulsa 6, Washington 6, D. C. DISTRIBUTORS IN PRINCIPAL CITIES



Acme products are in use *Everywhere*

In every major industrial center, you will not have far to go—to see a successful and efficient installation of *ACME* Refrigeration or Air Conditioning equipment. In offering practical solutions to temperature control problems, *ACME* Engineers have had an opportunity to study normal and abnormal temperatures, humidity and prevailing conditions. From this long experience *ACME* Engineers have developed a line of refrigeration and air conditioning components that meet practically every requirement of the Refrigeration and Air Conditioning Industry. Whatever your immediate problem may be, the chances are that the nearest *ACME* representative can show you an actual installation of *ACME* products which is successfully meeting requirements similar to yours. *ACME* Products have been tried and are in actual use in practically every climate under practically every possible condition. You can depend on this long established and time tested line of major refrigeration components to give you efficient, low cost, long lasting service.

THE COMPLETE *Acme* LINE INCLUDES

Freon Shell and Coil, Shell and Tube and Ammonia Condensers.
***Dry-Ex Water Coolers**
***Hi-Peak Water Coolers**
Heat Exchangers
Unit Coolers
Oil Separators
Convectors
***Flow Cold Liquid Chillers**
Evaporative Condensers
Cooling Towers
Liquid Receivers
Air Handling Units

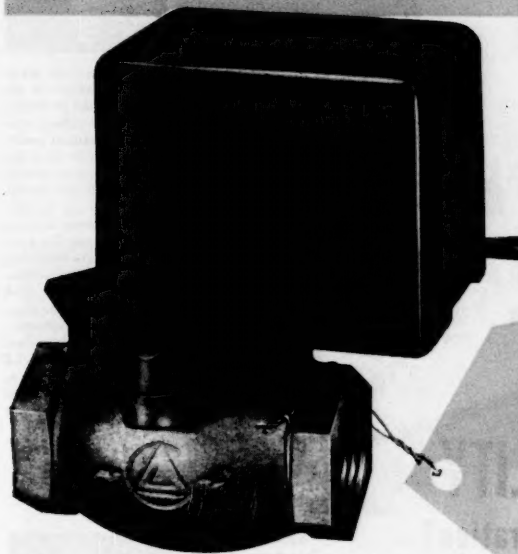
* TRADE MARK

Free Consultation with ACME Engineers is yours for the asking.
Write ACME INDUSTRIES, INC., Dept. HV, Jackson, Michigan

ACME INDUSTRIES, INC., JACKSON, MICHIGAN, U.S.A.
Refrigeration and Air Conditioning Division

CONTINUOUSLY SERVING THE AIR CONDITIONING AND REFRIGERATION INDUSTRY SINCE 1919

demand DETROIT CERTIFIED CONTROLS



This Exclusive Combination of DETROIT Features

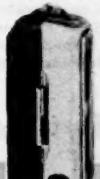
V-579 "BI-FLEX" GAS VALVE

- ★ Quiet operation—no click, no hum. An ideal replacement for noisy valves.
- ★ Rugged, compact design—easy to service.
- ★ Inexpensive.
- ★ Adaptable to all gases.
- ★ "Bi-flex" motor operated—low voltage.
- ★ Temperature and voltage compensation.
- ★ Snap-action opening and positive closing.
- ★ ½ inch to 1¼ inch sizes.

The exclusive features of the V-579 "Bi-flex" Gas Valve prove that you get more for your money when you deal with DETROIT. You can always count on giving your customers a better job when you install any DETROIT control. DETROIT controls are designed and built to fill your customers' needs—to give real economy and reliability through years of trouble-free service. The V-579, for example, at low initial cost, gives your customers an exclusive combination of outstanding features which provide new standards for the efficient and quiet operation of modern gas burning equipment. And that's exactly the kind of operation that pays off with more comfort for the user, more sales and profits for you. So take advantage of this extra value—insist that your source of supply furnish DETROIT controls with all your heating equipment. Write for Bulletin No. 229.

Means More Comfort for your Customers

More Profits for You!



No. 411 Thermostat—A sensitive and accurate *Timed Cycling* thermostat for all types of heating systems. Provides close control of room temperature. Attractively styled, easily installed and adjusted. Write for Bulletin No. 193 and Form No. 1545.

DETROIT LUBRICATOR COMPANY

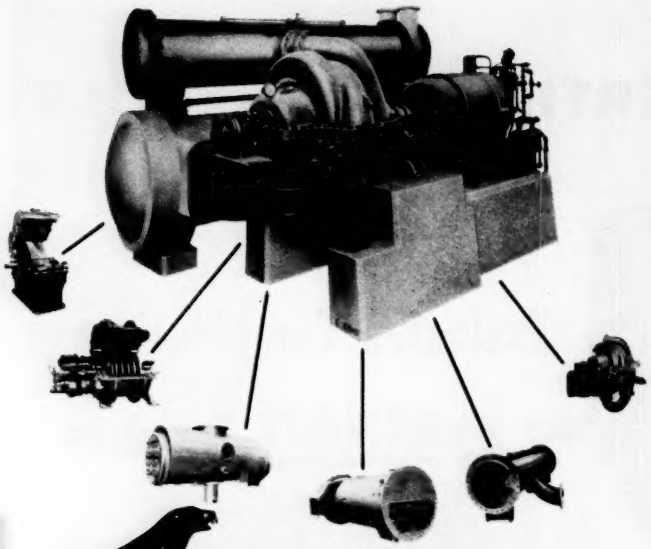
5900 TRUMBULL AVE., DETROIT 8, MICHIGAN

Division of American Radiator & Standard Sanitary corporation

RAILWAY & ENGINEERING SPECIALTIES, LTD.
Canadian Representatives in Montreal, Toronto, Winnipeg.

"DETROIT"

DETROIT HEATING AND REFRIGERATION CONTROLS • ENGINE SAFETY CONTROLS • FLOAT VALVES AND OIL BURNER EQUIPMENT • DETROIT EXPANSION VALVES AND REFRIGERATION ACCESSORIES • STATIONARY AND LOCOMOTIVE LUBRICATORS



Where do you get

UNDIVIDED RESPONSIBILITY

in an installation of centrifugal refrigeration?

Worthington will "wrap up a package".

Unlike other manufacturers of air conditioning and refrigeration equipment, Worthington *makes*—not just assembles—all the major components for each installation.

Compressor, condenser, cooler and such drive equipment as steam turbines, steam condensers, motors, and step-up gears—are all made in Worthington's own plant—each carefully designed for balanced operation with its companion components.

So the builder and owner can place full responsibility on the one supplier —Worthington.

Worthington centrifugal systems are used with most refrigerants and for any process—chilling water, brine, chemicals, lubricating oils—for temperatures as low as minus 160 F, capacities from 150 to 2600 tons.

A typical Worthington compressor feature is the arrangement of the volute passages and impellers to counterbalance the radial and axial thrusts, respectively, in the various stages.

Write for Bulletin C-1100-B14 on Worthington centrifugal refrigeration.

Worthington room conditioners for both heating and cooling are built to operate with chilled water or direct expansion cooling, capacities from 350 to 600 cfm for under-window installation.

PACKAGE UNITS SELECTED TO COOL HUGE OFFICE BUILDING

This is an excellent example of how Worthington's complete line makes it possible to select exactly right equipment.

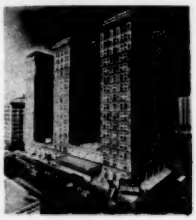
The new office building at 488 Madison Avenue, New York—home of many famous magazines and large industrial firms—is air conditioned primarily by package units, assisted by a Freon-12 reciprocating system with chilled water and steam coils.

Purpose of using package units in a big building like this is to provide for a variety of conditions imposed by both the building and the type of tenants: air conditioning needed only on top floors during certain seasons, difference in sun load on various sections, certain tenants working late hours but only with skeleton forces.

Second through 20th floors are handled by 38 Worthington 20 and 25 ton Package Air Conditioners, two per floor. Basement, first floor and top three floors are handled by two Worthington 75-ton Freon-12 compressors complete with condensers, pumps, water coolers and five central station units with chilled water and steam coils. Total capacity is 1050 tons.

Builders and owners: Uris Bros. Consulting engineer: Henry Oehrig. Air conditioning contractor: Raisler Corp. Architects: Emery Roth & Sons. All of New York.

RICE HOTEL MULTIPLIES COMFORT-COOLING WITHOUT REQUIRING MORE ROOM



Last year, Houston's Rice Hotel completed air conditioning its entire building, including a thousand guest rooms, dining rooms and meeting rooms, by installing three Worthington 600-ton centrifugal chilled water systems.

This equipment, utilizing Freon-11, replaced ammonia refrigeration equipment having a capacity of 350 tons, yet occupies no more space than formerly.

Worthington equipment was selected primarily because Worthington could provide 100% equipment of its own make. The compressors are driven by Worthington steam turbines and steam condensers.

Engineer: Reg. F. Taylor. Mechanical Contractor: Charles G. Heyne & Co. Architect: Kenneth Franzheim. All of Houston.

WORTHINGTON

AIR CONDITIONING AND REFRIGERATION

INVESTIGATE

MORE WORTH WITH WORTHINGTON

Consult Classified Telephone Directory for nearest Worthington distributor. Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, N. J., specialists in air conditioning and refrigeration for more than 50 years. A.1.2

nyb

Investigate

COMET
Unit Heaters

BUILT TO MEET MODERN INDUSTRIAL REQUIREMENTS FOR CONTINUOUS HEATING SERVICE UP TO 150 POUNDS STEAM PRESSURE

Horizontal Type

Ceiling suspension type with heavy duty welded steel fin-and-tube heating element. The rugged arc-welded construction out-performs and outlasts heating elements made of thinner non-ferrous metals. Avoids their expansion-contraction faults, yet has the same BTU efficiency. Ten basic sizes with capacities from 30 Mbh to 490 Mbh. Totally enclosed motors. (Extra heavy non-ferrous coils also available.)

Vertical Projection Type Also Available

For efficient heating from high-ceiling areas—for door heaters over small openings—or where the horizontal type Comet Heater is not applicable. Ten basic sizes; capacities from 27 to 332 Mbh.

●

WRITE FOR BULLETINS
No. 513 HORIZONTAL TYPE
No. 484 VERTICAL TYPE

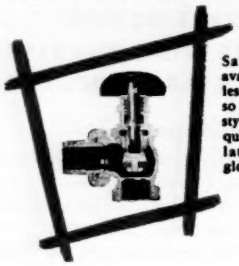
nyb

THE NEW YORK BLOWER COMPANY
SALES OFFICES • 32nd STREET and SHIELDS AVENUE • CHICAGO 16
FACTORY, LAPORTE, INDIANA

Schools from Coast to Coast

Here are just a FEW of the schools built during 1950-51, equipped with SARCO HEATING SPECIALTIES

Sarco Radiator Trap, type H, for 30 years the standard on all types of two-pipe steam heating systems. Sizes ½" to 1", angle, straightway, offset and vertical styles.



Sarco Radiator Valve, available in spring-packless style as illustrated; also in the bellows-packless style. Sizes ½" to 1½", quick opening and modulating types; angle or globe.

Sarco Float-Thermostatic Trap, type FTL for end-of-main and riser drips; also unit heaters and hot water generators. Fitted with Sarco thermostatic air vent. Air binding is impossible.

Write for Catalog 151.

State	*City*	*School*
California	Westwood	U.C.L.A.—Geology and Chem. Bldg.
Connecticut	Danbury	Park Avenue School
Connecticut	New Haven	Winchester Elementary School
Connecticut	Wilton	Wilton Junior High School
Florida	Haines City	Junior-Senior High School
Idaho	Coeur D'Alene	Coeur D'Alene School
Illinois	Freeport	Junior High School
Illinois	Lincolnwood	Lincolnwood Elementary School
Illinois	Wauconda	Wauconda Township High School
Indiana	Mishawaka	Bremen School
Iowa	Cedar Rapids	Buchanan Elementary School
Louisiana	Bogalusa	Bogalusa High School
Maryland	Baltimore	Edison-Barton-Mergenthaler High School
Massachusetts	Taunton	New School for Feeble Minded
Michigan	Galesburg	Galesburg School
Mississippi	Gulfport	Northeast Ward Elementary School
New Hampshire	Lebanon	Canaan Elementary School
New Jersey	Lakewood	Public School No. 5
New Jersey	Newark	Dayton Street School
New Jersey	Passaic	Grant School No. 7
New York	Bronx	Junior High School No. 125
New York	Brooklyn	Junior High School No. 14
New York	New York	Public School No. 192
New York	Roslyn	East Hills Elementary School
New York	Stony Brook	Stony Brook Elementary School
North Carolina	Lumberton	Pembroke-Rowland School
Ohio	Cleveland	Case Institute of Technology
Ohio	Lyndhurst	Anderson Road School
Oregon	Eugene	Eugene High School
Pennsylvania	Annville	Lebanon Valley College
Pennsylvania	Franklin County	Mainsville Elementary School
Pennsylvania	Williamsport	Williamsport Jr. High School
Pennsylvania	York	York Township Elementary School
Tennessee	Nashville	Gallatin High School
Texas	Austin	Casis School
Texas	Waco	Waco High School
Utah	Salt Lake City	West High School (Gymnasium)
Washington	Richland	Chief Joseph High School

and many, many other schools

SARCO COMPANY, INC.

EMPIRE STATE BUILDING, NEW YORK 1, N. Y.

Represented in Principal Cities
SARCO CANADA LTD., TORONTO 5, ONTARIO

ALWAYS SPECIFY SARCO 354

Sarcotherm
Modulating Heat Control

Selected for

SMOKE RISE

Luxury Homes

Ninety-one distinctive, custom built homes have been completed in this exclusive club development comprising 5000 acres of unspoiled country near Butler, New Jersey, 30 miles northwest of New York.

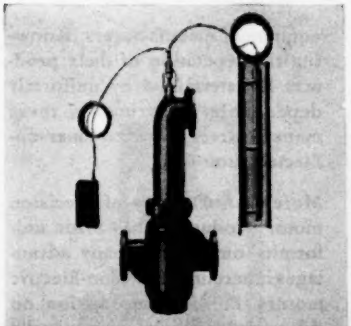
Prominent among outstanding modern improvements built in by the architect, Carl Kemm Loven, A.I.A., of Glen Rock, N. J., is the extensive use of

RADIANT HEATING

with Sarcotherm Control, thus assuring complete comfort for the occupants under all weather conditions.

For full information ask a Sarcotherm engineer to see you —there is one near you—or write for complete catalog.

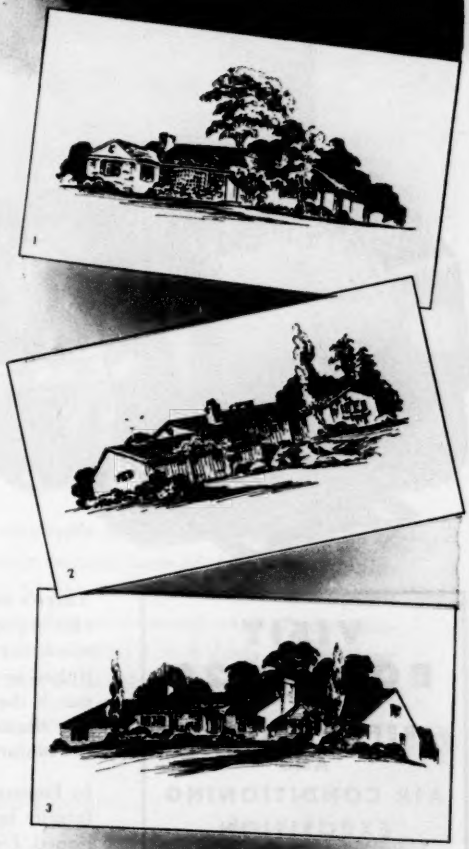
SARCOTHERM CONTROLS, INC.
Empire State Building, New York 1, N. Y.
A SARCO PRODUCT



The heart of the Sarcotherm control system of forced hot water or radiant heating is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they vary the proportion of system water re-circulated, to maintain the desired room temperatures.

The Sarcotherm Comfort Control Thermoray is an extremely sensitive thermostat affected by both radiation and convection.

While designed for radiant heating, it is equally effective controlling circulating pumps, motorized valves, or electrically heated panels.

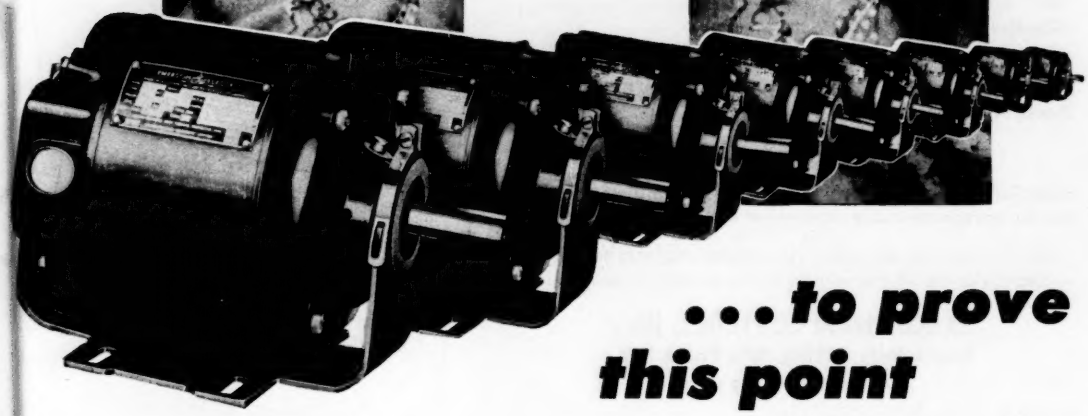


Three typical residences at Smoke Rise, designed by Carl Kemm Loven, A.I.A., Architect:

1. William Nicholson III
2. Douglas Weller
3. John D. Foley

21

Two are Better Than One



. . . to prove this point

VISIT BOOTH 524

REFRIGERATION AND AIR CONDITIONING EXPOSITION

Navy Pier Chicago, Ill.

Nov. 5 to 8

There's nothing unusual in being able to produce *one good motor.* But when that single unit must be multiplied by thousands, and all must match the original, it is a factor you should consider in selecting the motor for your products.

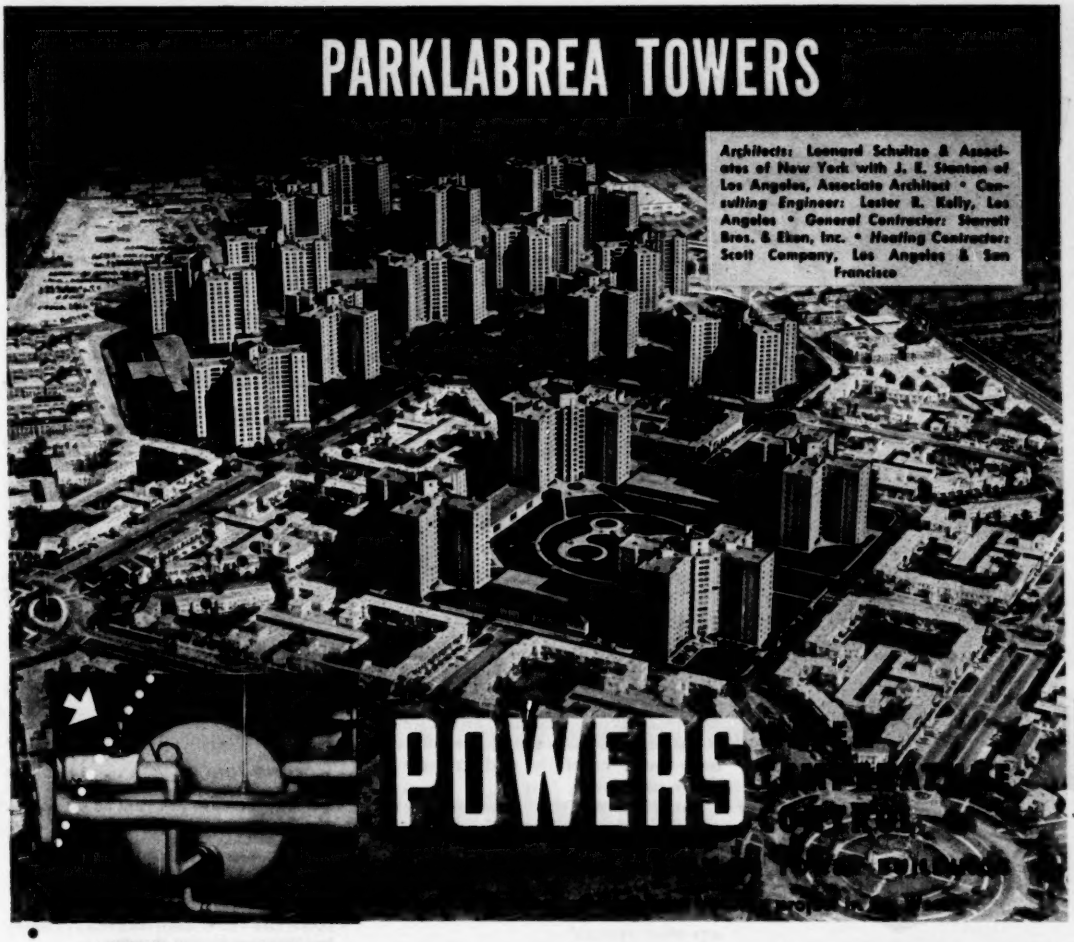
In Emerson-Electric motors, uniformity in appearance is unquestioned. *Uniformity of performance,* the important factor, has earned for them wide acceptance among America's leading appliance and equipment manufacturers. Knowing the reputation of their products is determined by uniformly dependable performance, these manufacturers turned to Emerson-Electric motors.

More than 61 years of precision motor production has made uniformity one of the many advantages inherent in Emerson-Electric motors. For full information on this complete line of motors in the 1/20 to 5 h.p. range, write today for Bulletin No. 175.

EMERSON ELECTRIC
MOTORS • FANS — APPLIANCES

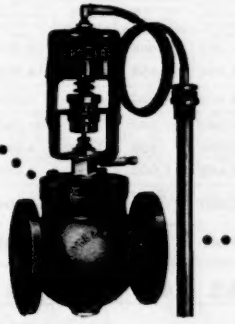
THE EMERSON ELECTRIC MFG. CO.
St. Louis 21, Mo.

PARKLABREA TOWERS



Architects: Leonard Schultze & Associates of New York with J. E. Stanton of Los Angeles, Associate Architect • Consulting Engineer: Lester B. Kelly, Los Angeles • General Contractor: Starrett Bros. & Eken, Inc. • Heating Contractor: Scott Company, Los Angeles & San Francisco

POWERS



Provides Best Insurance obtainable for dependable regulation of domestic hot water storage heaters. Each of the 13 story buildings contains 2 Powers 3″ No. 11 Regulators. They stop hot water complaints by preventing over-heated water. Fuel economies alone often pay back their cost 3 to 6 times a year. Many users report 15 to 25 Years of Reliable Control.

For help in selecting the right type and size regulator for your requirements contact your nearest Powers office. There's no obligation.

THE POWERS REGULATOR COMPANY

POWERS CONTROL 60th ANNIVERSARY 1891 1951

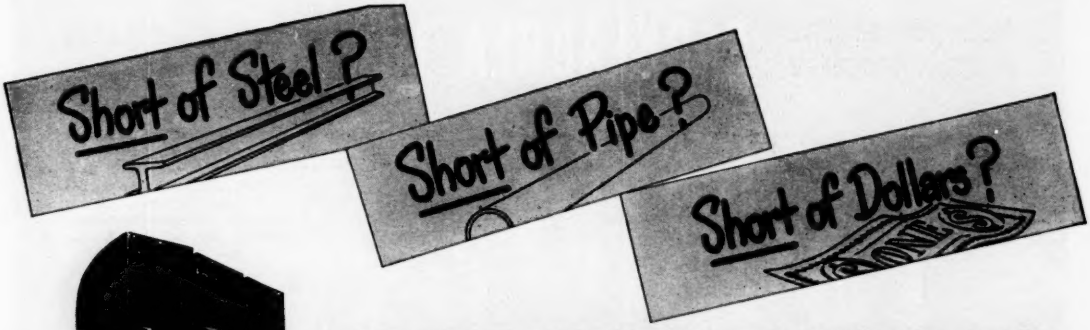
36 POWERS No. 11 Temperature Regulators used in the 18 tower buildings shown above.

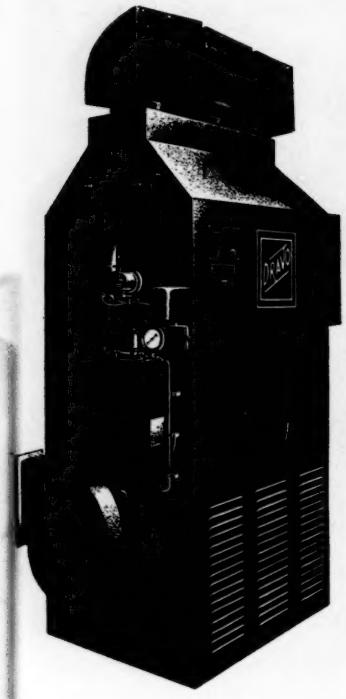
Only one of many types of POWERS Control.

SKOKIE, ILL. • OFFICES IN OVER 50 CITIES

Chicago 13, Ill., 3819 N. Ashland Ave. • New York 17, N. Y., 231 E. 46th St. • Los Angeles 5, Cal., 1808 West 8th St. Toronto, Ont., 195 Spadina Ave. • Mexico, D. F., Apartado 63 Bis.

(ad5)





DRAVO HEATERS CONSERVE STEEL,

MONEY—FUEL—and MAN HOURS

The steel needed for a heating system *can* be slashed from 50% to 70% for the representative open-space industrial structure shown below . . . by using the direct-fired warm air heating method with Dravo "Counterflo" Heaters! This conservation of steel, vitally important today, adds another saving to the long list of economies in money, fuel and labor effected by this heating method.

The chart below gives the detailed comparative story. Every system is equivalent in Btu output. Steel requirements for the 13 methods have been carefully and conservatively calculated.

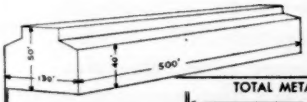
You will see that Dravo Heaters not only take LESS steel in each fuel classification . . . but that the HIGHEST steel requirement in a Dravo installation is *almost 50% less* than the LOWEST steel requirement in *any other* system!

Look at the contrast in *pipe* required! Jobs now held up by slow pipe deliveries can MOVE . . . if Dravo heaters are used!

Dravo "Counterflo" Heaters can expedite installation jobs for you! And the steel and pipe savings are just two of the many reasons why more and more "Counterflo" Heaters are being used in all types of structures.

DRAVO HEATERS HAVE EARNED HIGHEST INDUSTRIAL ACCEPTANCE BECAUSE THEY OFFER—

- **LOW FIRST COST . . . Users report 50% to 60% savings**
- **WORKING-ZONE WARMTH . . . Units heat 4,000 to 20,000 sq. ft.**
- **NO FUEL WORRIES . . . Burn oil or gas . . . readily converted**
- **AUTOMATICALLY CONTROLLED . . . On-off or modulating controls**
- **LOW OPERATING COST . . . 80-85% efficiency**
- **EASY INSTALLATION . . . Fuel, electric and exhaust connections only**
- **LONG LIFE—LOW MAINTENANCE . . . Stainless Steel combustion chamber**
- **TESTED—APPROVED . . . AGA and/or UL seal**
- **AVAILABLE . . . Immediate delivery, no delays**



Each heating system compared below was sized to make up a calculated 12,000,000 Btu heat loss in this representative industrial building.

WRITE TODAY FOR BULLETIN KL-526

TOTAL METAL REQUIREMENTS FOR VARIOUS HEATING SYSTEMS WITH IDENTICAL 12,000,000 Btu LOAD

COMPONENT	GAS FIRED					OIL FIRED					COAL FIRED		
	DRAVO WARM AIR	HIGH PRESSURE CONVENTIONAL WATER TUBE BOILER	HIGH PRESSURE PACKAGED STEAM GENERATOR	LOW PRESSURE CONVENTIONAL WATER TUBE BOILER	LOW PRESSURE PACKAGED STEAM GENERATOR	DRAVO WARM AIR	HIGH PRESSURE CONVENTIONAL WATER TUBE BOILER	HIGH PRESSURE PACKAGED STEAM GENERATOR	LOW PRESSURE CONVENTIONAL WATER TUBE BOILER	LOW PRESSURE PACKAGED STEAM GENERATOR	DRAVO WARM AIR	HIGH PRESSURE CONVENTIONAL WATER TUBE BOILER	LOW PRESSURE CONVENTIONAL WATER TUBE BOILER
BASIC HEAT GENERATORS	26,400	38,000	62,000	38,000	62,000	26,400	38,000	62,000	38,000	62,000	27,450	38,000	38,000
PIPING—Oil—Steam Boiler Room—Gas	9,096	15,490	15,490	35,308	35,308	4,352	15,790	15,790	35,608	35,608		14,990	34,808
TANKS—Oil—Blow-off Condensate		3,500	1,500	1,500	1,500	13,000	16,500	14,500	14,500	14,500		3,500	1,500
UNIT HEATERS including Traps & Starters		21,240	21,240	21,240	21,240		21,240	21,240	21,240	21,240		21,240	21,240
STACKS & BREECHING	1,200	4,000	400	4,000	400	1,200	4,000	400	4,000	400	1,200	4,000	4,000
PUMPS—Fuel Oil Auxiliary Oil—Boiler Feed		1,000	1,000	1,000	1,000	400	1,400	1,000	1,400	1,000		1,000	1,000
STOKERS & FANS—including Dust Collectors Fuel Oil Preheaters							2,000		2,000		23,850	15,000	15,000
STRUCTURAL STEEL Boiler House Foundation Reinforcing		7,000	2,000	7,000			7,000	2,000	7,000			7,000	7,000
TONS of STEEL REQUIRED	DRAVO **18**	**45**	**52**	**54**	**61**	DRAVO **23**	**53**	**58**	**62**	**67**	DRAVO **26**	**52**	**61**

DRAVO CORPORATION

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Better radiant heating systems start with Bundyweld Tubing

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It stands alone, the only tubing double-walled from a single strip, with an exclusive beveled seam-edge. It's copper-brazed through 360° of wall contact into a smoother, stronger, solid-wall tube that spells leakproof, efficient radiant heating systems right from the start.

Bundyweld comes to you in twenty-foot lengths with one end expanded if specified. It fabricates quickly, easily at your shop or building site. No kid-glove handling; it's ductile, yet extra-strong. One man easily forms Bundyweld on a simple bending fixture. Just two men quickly position the lightweight, rigid grids.

Get more detailed information on the *unique* radiant heating advantages that double-walled Bundyweld offers. Check your ***Sweet's Architectural File*** or write us now. ***Bundy Tubing Company, Detroit 14, Michigan.***

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DOUBLE-WALLED FROM A SINGLE STRIP

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Bonding metal fuses with basic metal, presto—

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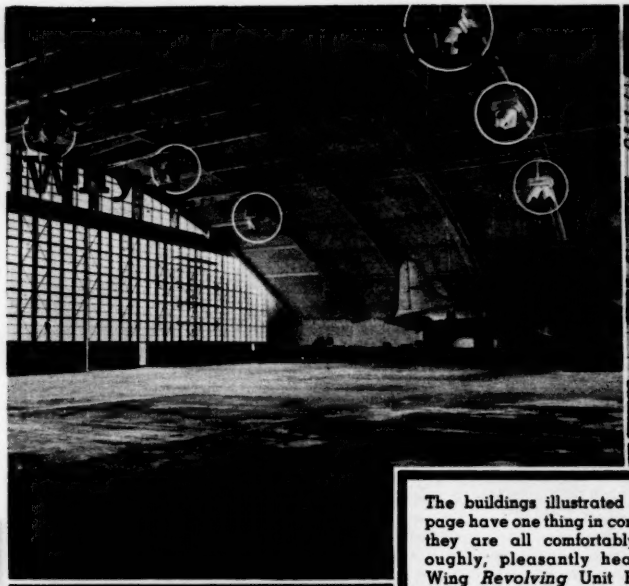
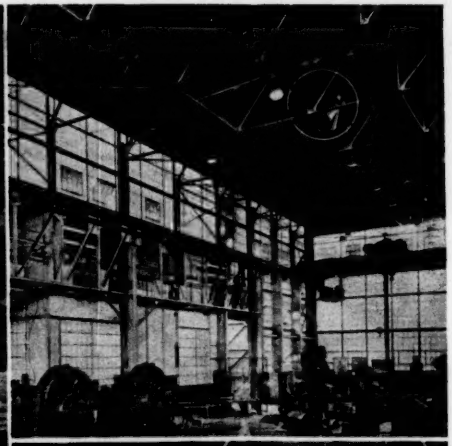
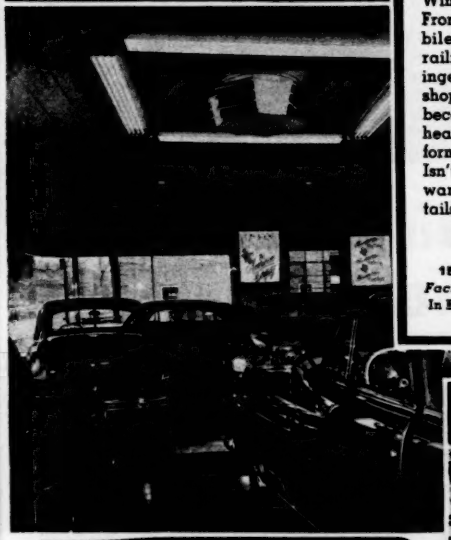
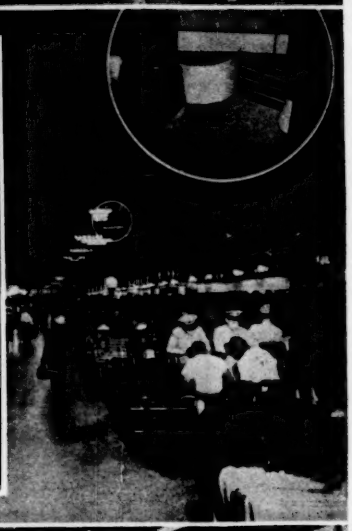
NOTE the exclusive patented Bundyweld beveled edge, which affords a smoother joint, absence of bead and less chance for any leakage.









The buildings illustrated on this page have one thing in common—they are all comfortably, thoroughly, pleasantly heated by Wing *Revolving* Unit Heaters. From airplane factory to automobile showroom—from gigantic railroad terminal and high-ceilinged factory to railroad repair shop, working conditions are ideal because the heated air from overhead is circulated slowly and uniformly in gently revolving streams. Isn't that the sort of heating you want in *your* plant? Get the details. *Write for bulletin.*

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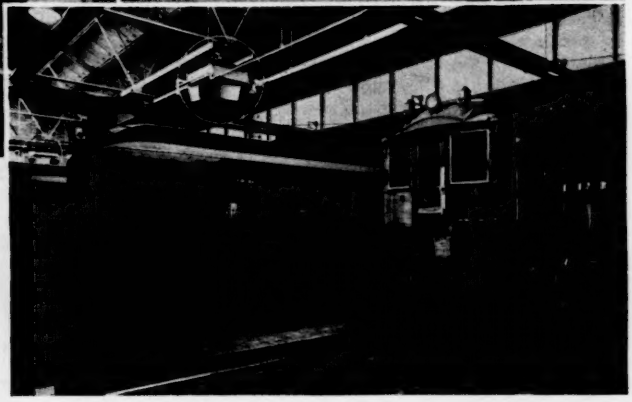
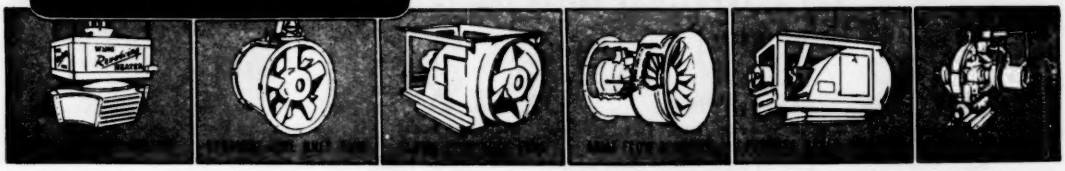
In Europe: WANSON, Brussels, Belgium

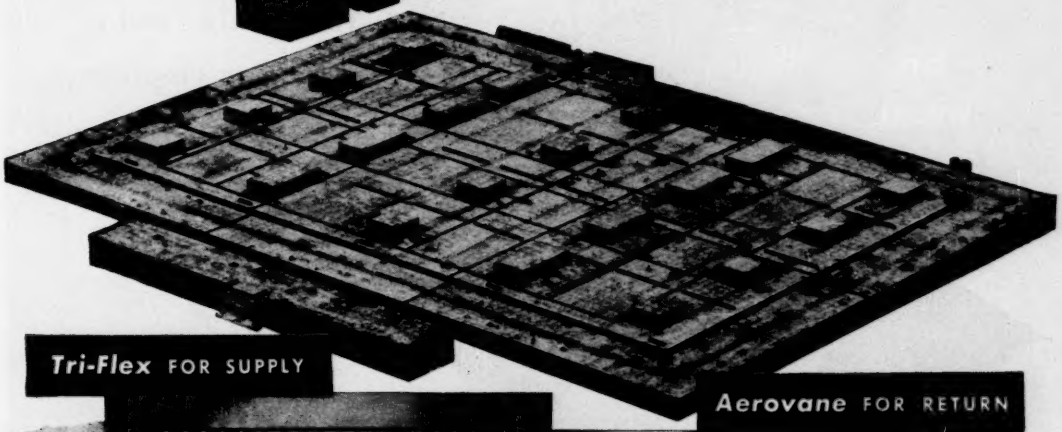


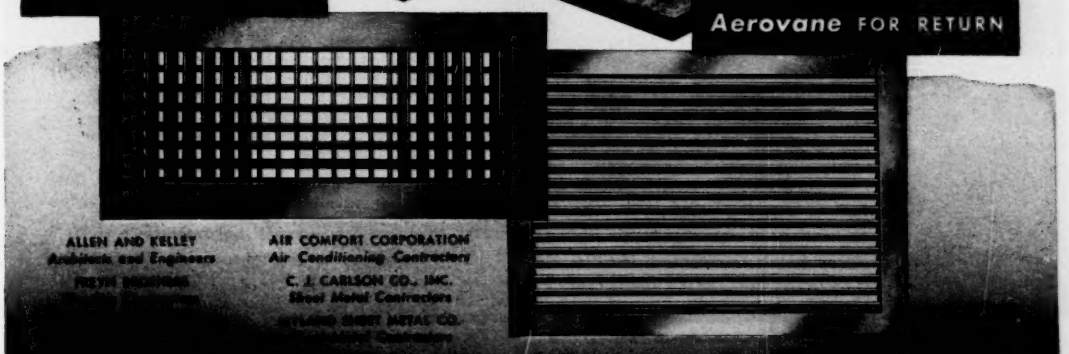
Wing

REVOLVING UNIT HEATERS



Tri-Flex . . . Aerovane . . . in the Western Electric Company Indianapolis Plant





In outstanding buildings from coast to coast where air conditioning is important to improved working conditions or customer comfort . . . or essential to manufacturing processes, as it is in the new Indianapolis Plant of the Western Electric Company . . . you'll find Tri-Flex and Aerovane Grilles and Registers installed at the all-important distribution end of the systems. The engineers, architects and contractors — the men responsible for the efficient performance of these jobs — know from experience they can depend on the Tri-Flex and Aerovane combination to insure the maximum, flexible control of air delivery necessary to meet the most exacting requirements.

Be wise, standardize . . . with T & B Standards.*

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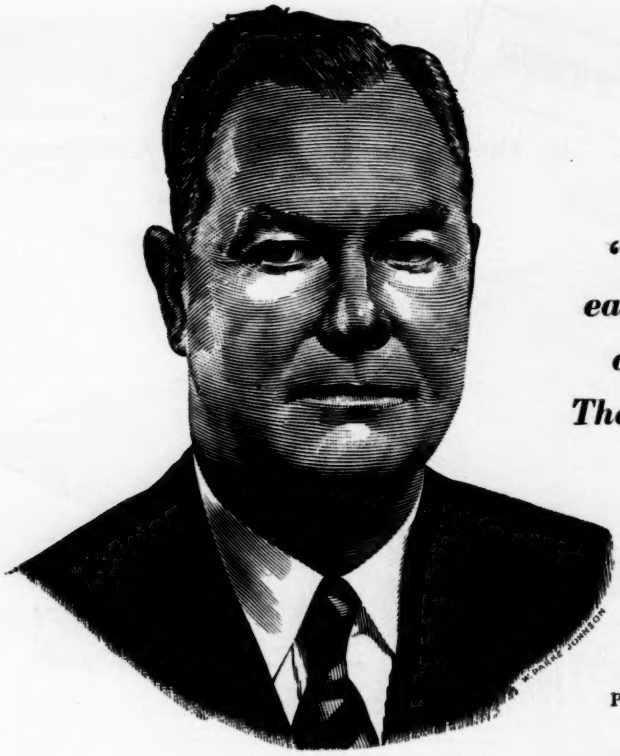
NEW BRITAIN, CONNECTICUT



"... Nearly nine out of each ten of our employees are ... participating in The Payroll Savings Plan."

E. J. HANLEY

President, Allegheny Ludlum Steel Corporation

"Systematic Savings offer the surest means of future security and we know of no better systematic savings plan than that afforded by payroll deduction purchases of U. S. Defense Bonds. Nearly nine out of each ten of our employees are helping their country while they save by participating in this plan."

There are three easily understood reasons why 88% of Allegheny Ludlum's 14,378 employees are enrolled in the Payroll Savings Plan:

- the recognition by Mr. Hanley and his associates of the Payroll Savings Plan as a major contribution to America's Defense effort . . . an important, stabilizing factor in our national economy . . . a road to personal security for Allegheny Ludlum employees.

- Allegheny Ludlum's person-to-person canvass of employees, which put an application blank for the Payroll Savings Plan in the hands of every man and woman on the company payroll.

- the patriotism and sound sense of the Allegheny Ludlum employees who know that every dollar they invest *each month* in U. S. Defense Bonds is a double duty dollar—it helps to keep America strong . . . it builds personal security for the employee.

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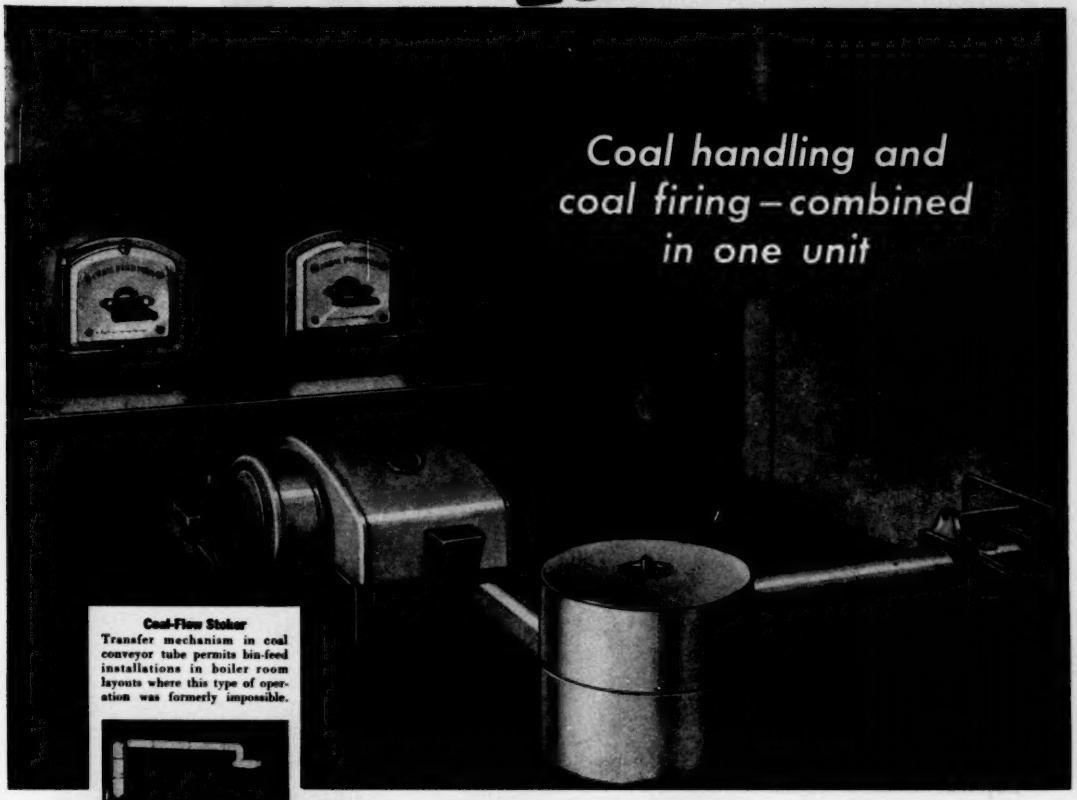
Make Steam the Low-cost Way



Coal-Flow Stoker
Transfer mechanism in coal conveyor tube permits bin-feed installations in boiler room layouts where this type of operation was formerly impossible.

Pneumatic Spreader Stoker
Dries, pre-heats, conveys, fires low cost coals. Highly responsive. Up to 1,000 boiler h.p. per nozzle.

Rotary Oil Burner
Fires low-cost No. 6 oils or lighter with complete steadiness at varying oil temperatures. To 500 boiler horsepower.

Commercial Gas Burner
Vertical type (above). Also Radiant Inshot and Ring types. Flexible operation, easily installed. To 400 boiler horsepower.

Can you afford to waste what Iron Fireman users are saving?

Iron Fireman stokers cut steam costs two ways:

1. Less coal. Clean, efficient fire gets more heat from coal. Automatic control of firing rate keeps fire adjusted to steam requirements at all times. No wasteful lag or over-run, even with extreme fluctuation of the boiler load.

2. Lower handling costs. Coal automatically fed direct from main coal bunker. Conveyor fits almost any boiler room layout. No driving mechanism inside coal bunker.

Mail coupon for more information, or call nearest Iron Fireman dealer for complete survey of your boiler plant. You assume no cost or obligation.

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☐ Coal-Flow Stoker ☐ Pneumatic Spreader Stoker
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on Heavy-Duty Steam Drying Units

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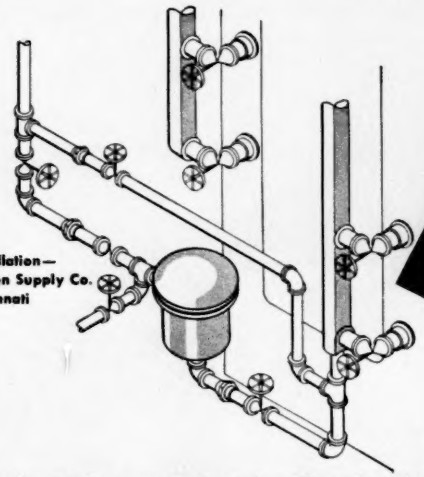

The installation—
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Cincinnati

PROBLEM: To equip a steam-heated tumbler-type drier with a trap that would reduce start-up time to a minimum, and provide, automatically, a smooth, steady flow of hot, dry steam to the unit, with the lowest possible maintenance cost.

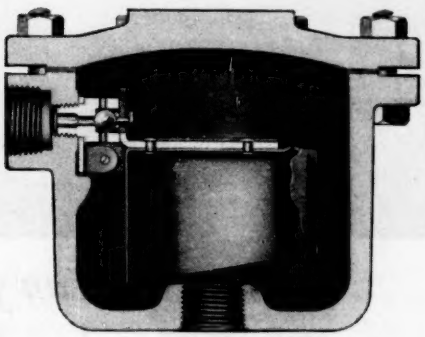
WORKING CONDITIONS: Steam pressure to drier, 125 pounds. Drier operated 16 hours daily on continuous batch basis.

SOLUTION TO PROBLEM: Crane No. 981, ¾-inch, 150-Pound Inverted Open Float Trap, carefully selected for adequate drainage capacity, and properly installed. (Now listed as No. 9810, with patented improved ball-type disc.)

RESULTS: Never requiring any repairs or new parts in more than 8 years' service, this Crane trap has given complete satisfaction. Periodic routine inspection only is total maintenance cost.

... ANOTHER TYPICAL CASE HISTORY demonstrating the better performance ... the lower ultimate cost of Crane Valves of all types ... and why—
More Crane Valves are used than any other make!

Rely on Dependable CRANE STEAM TRAPS



Crane Inverted Open Float Steam Trap with patented ball-type disc, for 1 to 300 pounds saturated steam working pressures. Literature on request from your Crane Branch or Crane Wholesaler.

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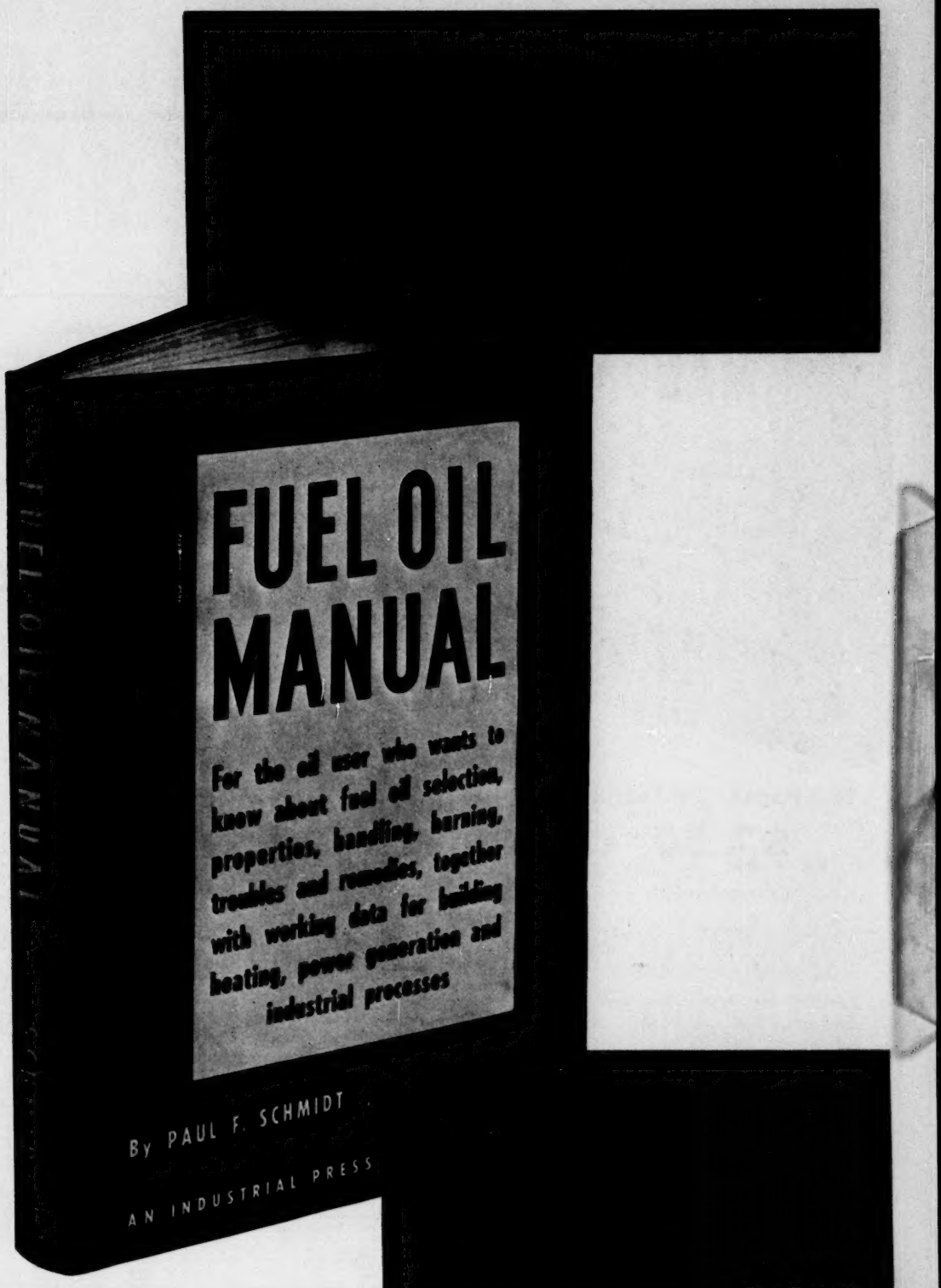
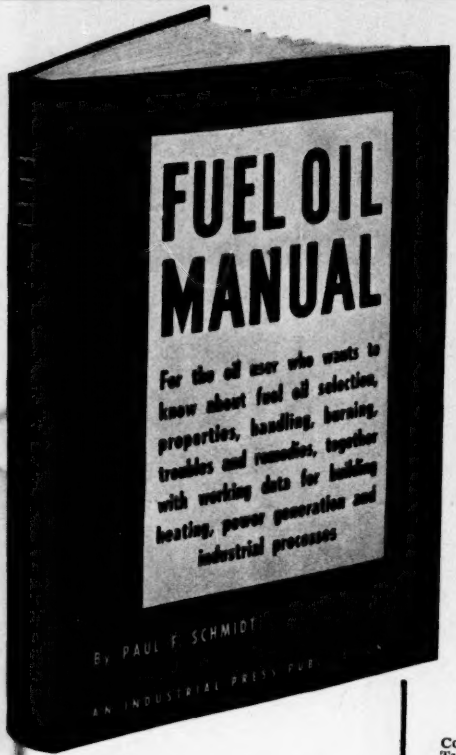

FUEL OIL MANUAL
For the oil user who wants to know about fuel oil selection, properties, handling, burning, troubles and remedies, together with working data for building heating, power generation and industrial processes
By PAUL F. SCHMIDT
AN INDUSTRIAL PRESS

See Details on Next Three Pages

PRACTICAL INFORMATION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By PAUL F SCHMIDT
AN INDUSTRIAL PRESS PUB

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COMPLETE TABLE OF CONTENTS

The list of subjects covered below illustrates the comprehensive character of FUEL OIL MANUAL. A complete four-page index enables you quickly to locate the information you want.

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BLENDING OF OILS—Grades of Oils Blended—Reasons for Blending—Methods of Blending—Blending by Heating, Agitation, Circulation and Gravitation

TRANSPORTATION AND STORAGE —Tank Car and Truck Delivery—Tanker and Pipeline Shipments—Method of Temperature Correction—Gauging of Storage Tanks—Abridged Volume Correction Table for Petroleum Oils — Capacities of Tanks — Oil Cost Table

FUEL OIL SPECIFICATIONS—No. 2 Distillates—No. 4 Oils—No. 5 and 6 Oils

COMPLAINTS AND CAUSES OF TROUBLE—Complaints or Symptoms, their Causes and Remedies—Unable to Start—Flame Goes Out or Fluctuates—Spitting, Sputtering, Sparkling—Poor Atomization and Combustion—Loss of Heat — Flash-back — Carbonization of Burner Tip — Carbon Formation on Furnace Walls—Carbon in Preheater—Blocked Burner Tip—Excessive Soot—Excessive Oil Consumption — Blocked Screens — Plugged Lines — Oil Not Pumpable—Loss of Suction—Water—Smoke — Corrosion — Discoloration of Ceramics — Bad Odor

ON *Properties Selection Handling Burning* OF FUEL OIL

If you *buy* fuel oil—**Do you know how to compare the properties of various grades and types? . . . how to specify and select the right oil for your purpose?**

If you *use* fuel oil—**Do you know the factors which influence efficient combustion? . . . how to analyze fuel oil troubles and apply the proper remedies?**

If you *sell* fuel oil—**Are you able to advise your customers intelligently? Can you answer their questions about fuel oil properties? . . . help them when trouble occurs?**

If you buy, use or sell fuel oil for building heating, power generation, marine applications or industrial processes, you will find FUEL OIL MANUAL, by Paul F. Schmidt, a convenient source of practical information that will give you a working knowledge of fuel oil and how to use it. Written by a chemist with many years' experience in the industry, it discusses fuel oil from the standpoint of the user. Theory and involved discussions of interest only to chemists or refiners are avoided. Step by step, starting with a brief description of the chemistry of petroleum and methods of refining, FUEL OIL MANUAL gives a comprehensive picture of the characteristics and uses of every type and grade of fuel oil, from No. 2 to No. 6. Technical language is avoided wherever possible, and all the terms used are fully explained.

The complete table of contents at the left illustrates how thoroughly the subject is covered. A chapter is devoted to each of the various important properties of fuel oil. In each case the author explains fully the meaning of each property, and shows how this information can be applied in selecting, handling or burning fuel oil. Fuel oil impurities and how they affect combustion are described fully, and the steps which can be taken to test for or avoid impurities are discussed. Of special interest is the chapter on Fuel Oil Treatments, which clears up a lot of misunderstanding on this subject, describes what a fuel oil additive can or cannot do, and analyzes the essential qualities which should be considered in selecting a fuel oil additive.

Another chapter which every user of FUEL OIL MANUAL will find valuable is the one on Complaints and Causes of Trouble. Here the author lists the troubles that may be encountered in using fuel oils, describes the symptoms of each, and shows the correct remedy to apply in each case. Many cases of fuel oil failure can be prevented or quickly remedied by becoming familiar with the contents of this chapter.

FUEL OIL MANUAL will give you a thorough knowledge of the properties of fuel oil . . . of the possibilities and limitations of each grade . . . of the methods you can use to assure uniform quality and efficient combustion . . . of how to diagnose fuel oil troubles and remedy them. It is a valuable addition to your working library that will show you how to get maximum value for your fuel oil dollar in every kind of application.

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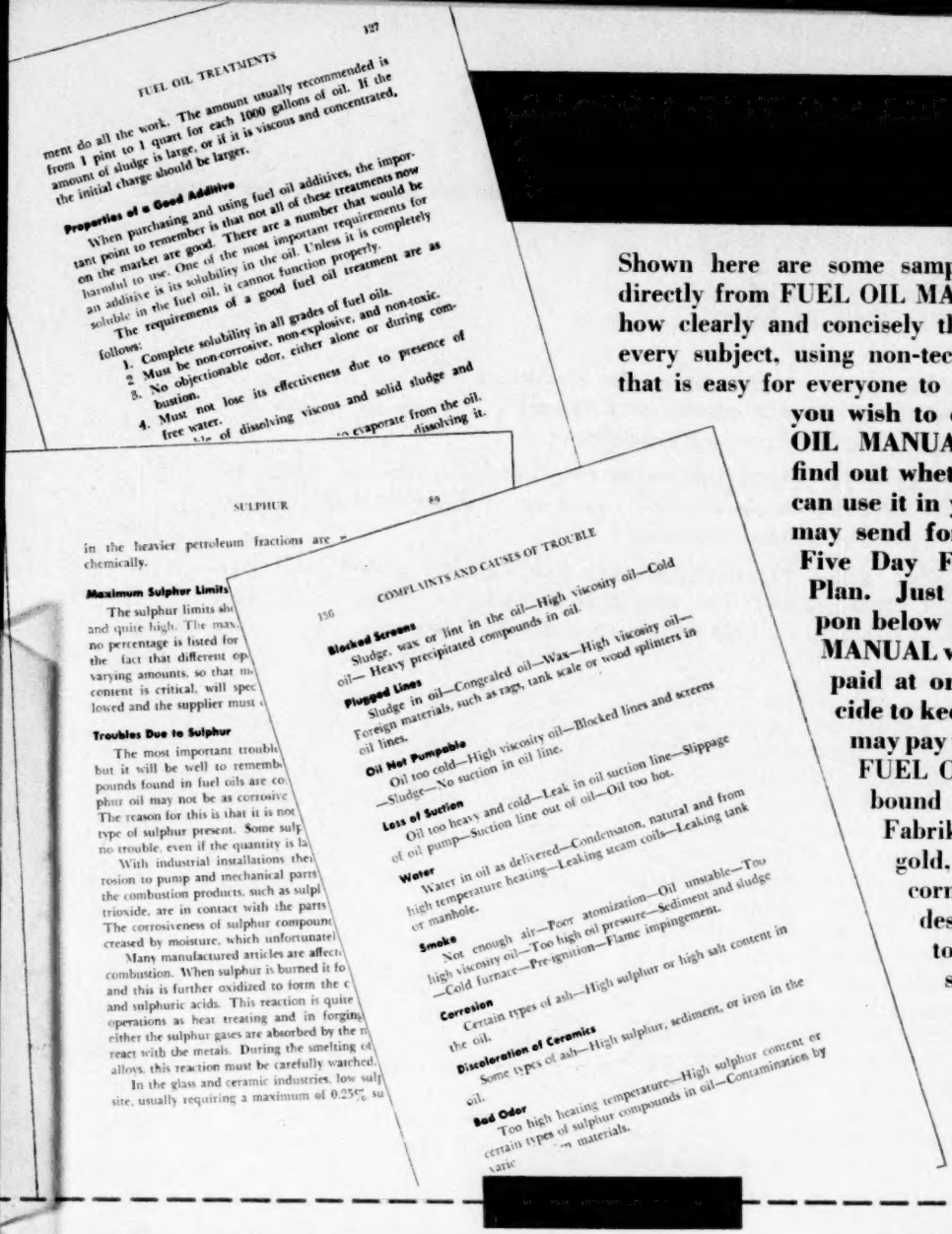

FUEL OIL TREATMENTS 127

ment do all the work. The amount usually recommended is from 1 pint to 1 quart for each 1000 gallons of oil. If the amount of sludge is large, or if it is viscous and concentrated, the initial charge should be larger.

Properties of a Good Additive

When purchasing and using fuel oil additives, the important point to remember is that not all of these treatments now on the market are good. There are a number that would be harmful to use. One of the most important requirements for an additive is its solubility in the oil. Unless it is completely soluble in the fuel oil, it cannot function properly.

The requirements of a good fuel oil treatment are as follows:

1. Complete solubility in all grades of fuel oils.
2. Must be non-corrosive, non-explosive, and non-toxic.
3. No objectionable odor, either alone or during combustion.
4. Must not lose its effectiveness due to presence of free water.

...ity of dissolving viscous and solid sludge and ...o evaporate from the oil, ... dissolving it.

SULPHUR 89

in the heavier petroleum fractions are ... chemically.

Maximum Sulphur Limits

The sulphur limits sh... and quite high. The max... no percentage is listed for ... the fact that different op... varying amounts, so that m... content is critical, will spec... lowed and the supplier must ...

Troubles Due to Sulphur

The most important trouble ... but it will be well to rememb... pounds found in fuel oils are co... phur oil may not be as corrosive ... The reason for this is that it is not ... type of sulphur present. Some sulp... no trouble, even if the quantity is la... With industrial installations the... rosion to pump and mechanical parts ... the combustion products, such as sulp... trioxide, are in contact with the parts ... The corrosiveness of sulphur compound... creased by moisture, which unfortunate...

Many manufactured articles are affecte... combustion. When sulphur is burned it fo... and this is further oxidized to form the c... and sulphuric acids. This reaction is quite ... operations as heat treating and in forging ... either the sulphur gases are absorbed by the m... react with the metals. During the smelting of ... allows, this reaction must be carefully watched.

In the glass and ceramic industries, low sulp... site, usually requiring a maximum of 0.25% su...

156 COMPLAINTS AND CAUSES OF TROUBLE

Blocked Screens
Sludge, wax or lint in the oil—High viscosity oil—Cold oil— Heavy precipitated compounds in oil.

Plugged Lines
Sludge in oil—Congealed oil—Wax—High viscosity oil—Foreign materials, such as rags, tank scale or wood splinters in oil lines.

Oil Not Pumpable
Oil too cold—High viscosity oil—Blocked lines and screens —Sludge—No suction in oil line.

Loss of Suction
Oil too heavy and cold—Leak in oil suction line—Slippage of oil pump—Suction line out of oil—Oil too hot.

Water
Water in oil as delivered—Condensation, natural and from high temperature heating—Leaking steam coils—Leaking tank or manhole.

Smoke
Not enough air—Poor atomization—Oil unstable—Too high viscosity oil—Too high oil pressure—Sediment and sludge —Cold furnace—Pre-ignition—Flame impingement.

Corrosion
Certain types of ash—High sulphur or high salt content in the oil.

Discoloration of Ceramics
Some types of ash—High sulphur, sediment, or iron in the oil.

Bad Odor
Too high heating temperature—High sulphur content or certain types of sulphur compounds in oil—Contamination by ... materials.

[redacted]

Shown here are some sample pages taken directly from FUEL OIL MANUAL. Notice how clearly and concisely the author treats every subject, using non-technical language that is easy for everyone to understand. If you wish to examine FUEL OIL MANUAL further, to find out whether or not you can use it in your work, you may send for it under our Five Day Free Inspection Plan. Just fill out the coupon below and FUEL OIL MANUAL will be sent postpaid at once. If you decide to keep the book you may pay within five days. FUEL OIL MANUAL is bound in flexible red Fabrikoid, stamped in gold, with rounded corners. It is written, designed and bound to give you long service at your desk and on the job.

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SEE HOW G. E. CAN HELP YOU CUT AIR CONDITIONING COSTS

The adaptability and equipment advantages of G-E Personal Weather Control Air Conditioning produce important savings in multi-room buildings of all kinds

Air conditioning that satisfies both building requirements and tenant desires...and yet is often substantially lower in cost than other systems—that's what you get with General Electric Personal Weather Control. Designed to supply year 'round comfort in office buildings, hospitals, hotels, apartment houses, and other multi-room structures, these newly-improved G-E Systems feature unparalleled flexibility.

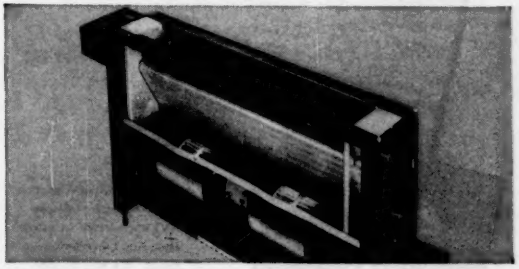
Building owners like the way G-E Systems can be quickly adapted to office rearrangement. Architects and engineers like the saving in space that is often possible because G-E Systems can be installed with small-size, high-pressure ducts or even without ducts. Tenants enjoy living and working in G. E.-air-conditioned buildings because they get individual room control of climate.

Here are a few of the ways you save!

LOWER INSTALLED COST! G-E Personal Weather Control Systems using the individual G-E Room Air Conditioner shown above often require substantially lower compressor capacity than competing systems. Application with small-size, space-saving ducts, or without ducts at all, can save both installation and building costs.

LOWER OPERATING COST! Since G-E Systems often require less compressor capacity, there's a saving in power cost too! Room units in unoccupied rooms can be shut off. When load conditions are reduced, units can be operated without running ventilation equipment. And G. E.'s filters help coils maintain top efficiency.

LOWER MAINTENANCE COST! All air—both room and ventilation—is filtered, protecting coils from dust and dirt which have been known to cut efficiency up to 15%. Simple, inexpensive filter replacement takes less than a minute. No costly coil cleaning.



LOWER REPLACEMENT COST! Attractive, rugged G-E Air Conditioners give top performance year after year. "Never had to replace one," says Clay J. Berry, The Fair Bldg., Fort Worth, where a 500-unit General Electric System was installed in 1939.

You can put your confidence in—

GENERAL ELECTRIC

General Electric Company, Air Conditioning Dept., Sec. HV-4, Bloomfield, New Jersey
Please send me, without obligation, detailed information on G-E Personal Weather Control Air Conditioning Systems.

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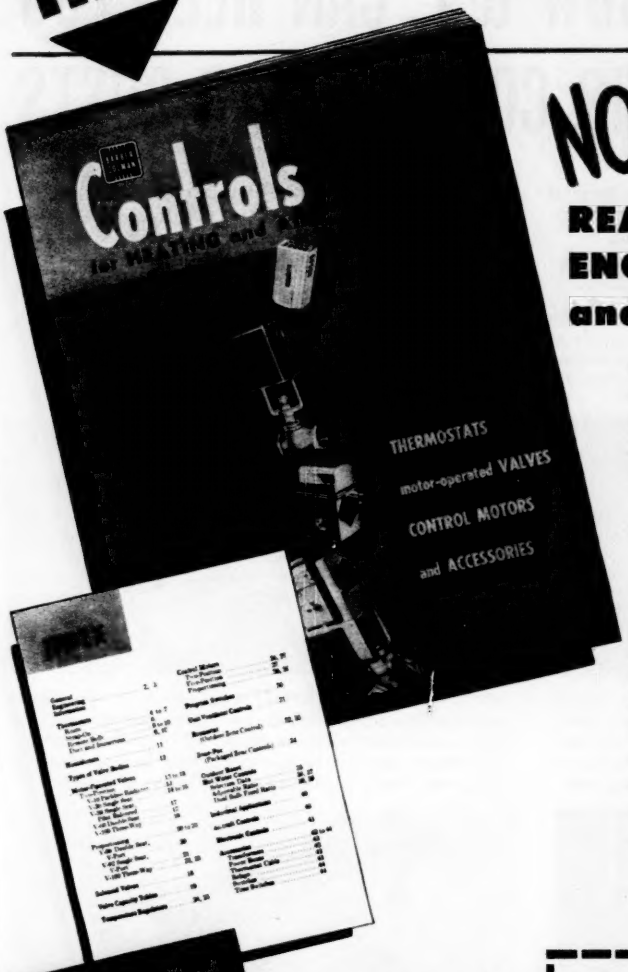

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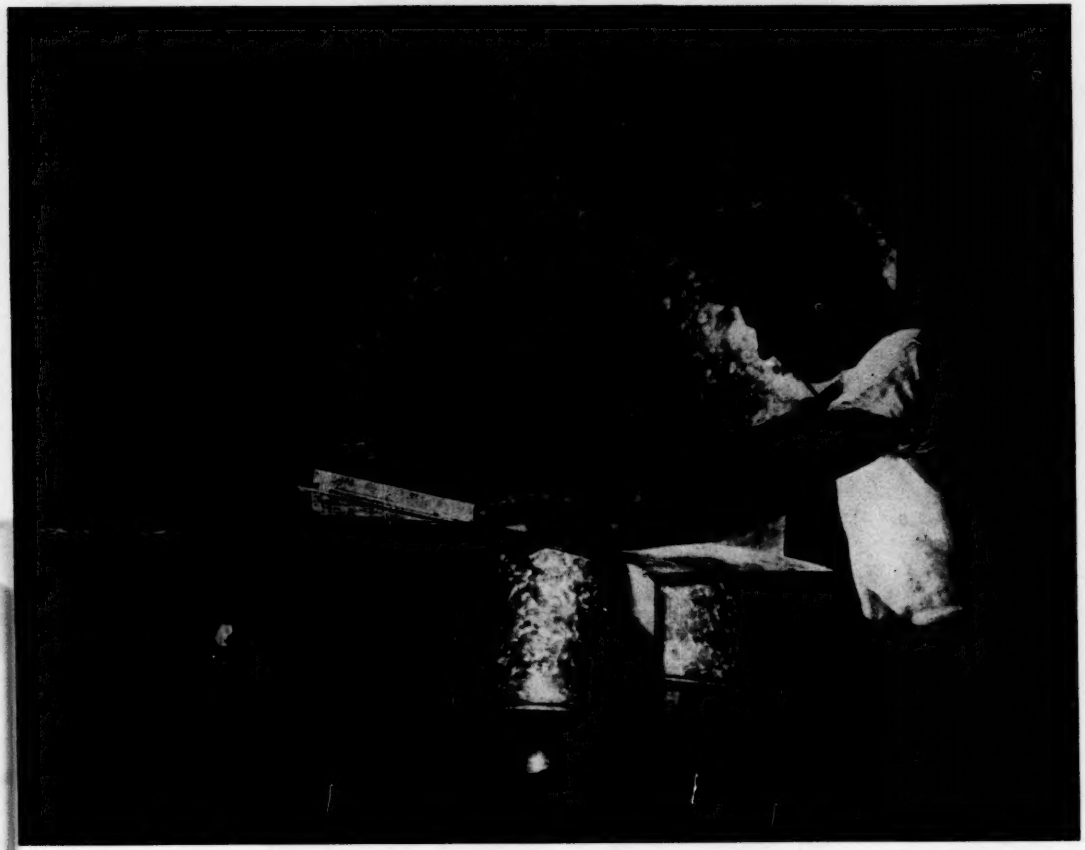

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Bethlehem Galvanized Steel Sheets are simple to fabricate. They can be cut, formed, seamed and soldered with no difficulty, using ordinary shop tools. Smooth, good-looking sheet-metal jobs can be done in minimum time.

These easy-working sheets are made of strong, durable steel, either plain or copper-bearing. A spangled zinc coating protects them against corrosion. Their cost is low, and they give excellent service. Dollar for dollar there are no better sheets for all-around work than Bethlehem Galvanized Sheets.

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Washington News

LORING F. OVERMAN

WITH Congress away from Washington until January 8, business and industry will have an opportunity to examine a new crop of laws without immediate concern about others sprouting overnight. Despite the fact that the present emergency is being used as the peg on which to hang all manner of legislative proposals, there is a general feeling in D. C. that business did not fare as badly as had been predicted.

In addition to conducting countless investigations, Congress completed:

A tax bill to raise an additional $5.7 billion; not the $16.5 billion proposed by President Truman, or the $10 billion considered rock bottom by the treasury secretary.

Rearmament appropriations totaling $90 billion for the session.

Foreign aid amounting to $8.05 billion, of which more than $7.2 billion is to be in new money.

Controls of prices, wages and rents through June 30, 1952—a date certain to be extended unless potential enemies fold completely.

A $5.8 billion construction program for military bases, and authorization to increase the armed forces to 3,500,000. Extension of the selective service legislation and authority to present to Congress a blueprint for universal military training.

All of the foregoing legislative developments, together with many others, have been discussed in the news columns far more completely than is either desirable or contemplated in this publication. They are listed merely because each one sparks some further development of direct interest to the heating, ventilating and air conditioning industries and its people.

Tax Ends Freeze

After the first shock of realizing that personal income taxes are to be increased approximately 11.75%, and that the combined normal and surtax rate for corporations has been raised to 52%, certain other effects of the tax are noted. For example, Charles E. Wilson, Director of Defense Mobilization, has announced termination of the 60-day freeze instituted August 18 on the issuance of certificates authorizing stepped-up amortization of new facilities for defense production.

That could mean that those whose plant expansion has been blocked by the moratorium may now make application for permission to proceed. Probably more important is the fact that termination of the moratorium signals resumption of building programs in which a tremendous amount of heating, ventilating, plumbing, air conditioning and similar equipment will be required. A formal system of priorities for processing applications is to be based upon the essentiality of the product to be manufactured. For the present, the lineup is as follows: (1) machine tools, cutting tools, dies, gages, jigs and fixtures; (2) pig iron; (3) sulfur; (4) military end items; (5) supporting products urgently needed by the Armed Services; (6) basic aluminum; (7) nitrogen; (8) aviation gasoline; (9) steel scrap; and (10) special aluminum extrusions.

$90 Billion for Defense

Appropriation of $90 billion for defense gives the military the cash to go ahead with plans for which it filed its first-quarter (of 1952) applications for controlled materials. It is interesting to see how those plans, coupled with the estimates of civilian requirements, dwarf available supplies of steel, copper, and aluminum.

Requests for steel during the first quarter of 1952 totaled 32,954,000 tons for both civilian and military use. Estimated supply was 21,125,000 tons. NPA allotted 23,214,000 tons—the overage being allowed on the assumption that some of the estimates were overgenerous.

First-quarter requests for copper amounted to 2,083,000,000 pounds; estimated supply, 1,231,000,000 pounds; allotments, 1,367,000,000 pounds.

Military and civilian estimates of aluminum requirements added up to 974,000,000 pounds, with 646,000,000 available and 713,566,000 allotted.

The military was assigned 12% of the steel, 24% of the copper, and 40% of the available aluminum.

A glance at the figures leaves little doubt that first-quarter demands of the military are certain to put the squeeze on civilian production. Manly Fleischmann, Defense Production Administrator, points out that the situation is not unexpected. "We have stated many times that the difficulties would begin about now," he said.

As a result, less essential products requiring aluminum and copper will be drastically curtailed in the first three months of next year. Most producers of consumer goods will be permitted to use only 50 to 60% of the steel, copper and aluminum they used last year, but no new restrictions are to be placed upon end products, according to Mr. Fleischmann. Through conservation measures and some substitution, it may even be possible for some plants to produce a greater quantity of civilian items than would ordinarly be possible with the amounts of materials they will receive, Mr. Fleischmann said.

"Up to now," he continued, "the economy has been going through a period of transition to full CMP operation. In the first quarter of 1952 the CMP program will be given its first real test of meeting our objective of effectively distributing critical materials needed to sustain a balanced program of defense, defense-related, and civilian production."

Effects of the authorizations in major areas have been outlined as follows:

In making allotments for schools, elementary schools were given preference. An effort has been made to provide ample material for rehabilitation of condemned structures.

Plan your Byers snow melting now!

it can do this winter for you!

How Byers Snow Melting Systems came through last winter's record breaking snowfalls is graphically shown in the above illustrations. These pictures are typical of the successful results of this modern snow removal system in a wide variety of applications. Coils of Byers Wrought Iron pipe, embedded in sidewalks and driveways and carrying hot water-anti-freeze solution, made the heaviest snow vanish magically as it fell.

Satisfied users everywhere are constantly adding new chapters to the snow melting success story. Householders find it both economical and convenient. Industrial plants use snow melting to keep loading platforms and access roads hazard-free. Stores, hotels and service stations have cut excessive snow removal costs and enjoy increased patronage. This ever-increasing acceptance is supported by remarkable records like those above.

Byers Wrought Iron pipe is ideally suited for this service because of its combination of essential qualities. Its corrosion resistance has been repeatedly proven. Its heat emission is high. It is easily formed and welded. It expands and contracts at virtually the same rate with concrete. And it has ample mechanical strength to withstand damage during installation.

Our bulletin, BYERS WROUGHT IRON PIPE FOR SNOW MELTING SYSTEMS, covers the design, installation and operation of snow melting. Write for your copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.

WHY GENUINE WROUGHT IRON LASTS

This notch-fracture test specimen illustrates the unique fibrous structure of genuine wrought iron—which is responsible for the high corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Materials allotted for hospitals should permit completion of projects under way, but little provision has been made for new starts.

Even the ship construction proposed has been trimmed because of an acute shortage of plates and structural steel shapes.

Allotments are sufficient to maintain petroleum production at a high level, but some proposed construction of gas transmission lines will be deferred.

In the building materials field, producers of building items using aluminum will be cut to low levels, but more steel will be available in the first quarter than in previous periods.

The railroad equipment program will be limited principally to construction of 18,000 freight cars, flat cars and gondolas.

Production of farm machinery will not be curtailed, but the Department of Agriculture, as claimant for the food production and distribution industries, has been asked to screen its construction applications to reflect both nondeferability and essentiality.

Controls Program

It may be expected that the reassembly of Congress on January 8 will set off another fight for more, bigger, and longer-lasting controls. The present extension of the Defense Production Act of 1950 expires on June 30 of 1952. President Truman is again expected to insist upon being given more power. He is known to have been very concerned over the refusal of Congress to revise the so-called Capehart amendment to the price control portion of the Defense Production Act.

Price Stabilization officials have contended that it is impossible to operate a price controls program under the amendment, which would permit manufacturers to adjust prices to reflect all costs since the outbreak of the Korean war. Oddly enough, when Congress adjourned, OPS got busy with drafts of regulations to implement the Capehart amendment. Business folk are sensing that the OPS version of the Capehart amendment will not be liked by industry. OPS also has its big guns leveled on the Herlong amendment—less publicized than the Capehart amendment—but equally irksome to pricing officials. The Herlong amendment requires that OPS rulings maintain customary retailer and wholesaler margins.

Construction and Fuel

Shifts in population, new military construction, defense housing, and the utilization of increased quantities of fuel of all kinds in manufacturing operations are causing some dislocation in the fuel field. Solid fuels, oil, and gas are all affected, with shortages of distribution facilities as the primary bottleneck. The Petroleum Administration for Defense (PAD) is taking prompt action to correct shortages wherever possible.

For instance: Oil pipeline projects which have received priorities assistance through the Petroleum Administration for Defense include 12 large ones with a total estimated cost of more than $236 million. Completion of the projects will require about 3,000 miles and .6 million tons of line pipe.

The Petroleum Administration for Defense has also given priorities aid to 12 major natural gas pipe line projects and a number of smaller ones for the fourth quarter of 1952. Total estimated construction cost of the projects is $554 million. When completed the facilities will have a gas capacity of 3 billion cubic feet per day. A total of .9 million tons of steel pipe will be required to complete the projects.

The major projects have been allotted 278,360 tons of pipe for the fourth quarter. In addition, 182,469 tons have been allotted for gathering lines, distribution lines and other smaller gas projects. Total gas line allotments of 460,829 tons were made for the fourth quarter.

Solid Fuels Too

Not entirely forgotten in arranging priorities assistance for gas and oil, is the plight of the producers of coal and coke. A new Order M-87 permits solid fuels producers to self-rate their orders for limited amounts of both controlled and non-controlled materials for minor capital additions and maintenance, repair and operating supplies. The order also provides a procedure to applying for priorities assistance to obtain major capital additions needed to speed up the production of fuels for defense plants and essential civilian industries.

The order affects coal mines, coal preparation and processing plants, merchant and integrated coke plants, and coal chemical and petroleum coke calcining facilities.

Metals Mines Seek Aid

In another effort to ease the metals pinch, Congressmen from mining states are readying for the next session a full-scale drive for government subsidies to miners for production of critical metals and minerals. Efforts are also to be made to consolidate all government mining authority—except over coal, gas, and oil—in a Federal Minerals Administration.

Synthetics Mentioned

Developments in the field of synthetic fuels, according to Interior Secretary Oscar Chapman, have progressed to the point where the "ominous spectre" of a fuel famine can be pushed back for generations.

"We can now say with complete confidence," he said, "that we will be able to supply ourselves with oil, and with the things that are made out of oil, for centuries to come." Mr. Chapman said the country has immense reserves of oil shale, and coal for conversion into oil.

He said that the Bureau of Mines produced 300,000 gallons of liquid fuels last year at its demonstration plant at Louisiana, Mo. He added that "the gasoline made has undergone the most rigorous tests by our military forces, with excellent results."

Water Pollution

A bill designed to encourage the construction of industrial waste treatment works by allowing rapid tax amortization (HR 5742) has been introduced in the House by Rep. Watkins Abbitt (D-WVa).

BRIEFLY STATED

• The Kramer Trenton Co. announces the appointment of S. Charles Segal, of Trenton, as general sales manager. Mr. Segal has been affiliated with Kramer Trenton for fifteen years and as its chief engineer for the past eleven years. As general sales manager, he will also direct the activities of the firm's advertising department.

• The purchase of the capital stock of Atlantic Steel Boiler Co. has been announced by John C. Barnes, formerly vice president for sales for the National Radiator Co. Mr. Barnes will be president of the organization which will operate under the name of Atlantic Steel Boiler Co., Inc. The personnel and facilities of the original company are being retained and extensive plans have been prepared for the expansion of the company activities, particularly with reference to sales representation in many new territories. The founder of Atlantic Steel Boiler Company, Mr. Wm. A. Bartley, has announced his plans for permanent retirement from the heating industry.

• Thermos boots for the Marines in Korea, tested at 45 degrees below zero, should eliminate the frostbite which claimed so many victims in the wet-cold of last winter. Actual tests of the sealed insulation rubber boots, with water frozen in the boots and wearers donning frozen socks, showed that ice melted in 8 minutes and feet stayed warm thereafter. So long as a man moves once an hour to keep circulation normal, Marines say the new boots will prevent trench foot.

• Copper and aluminum allotments for the first quarter of 1952 will be considerably below current Controlled Materials Plan quotas, the Mechanical Household Refrigerator—Farm & Home Freezer Manufacturers Industry Advisory Committee was informed at a meeting September 28 with the National Production Authority, U. S. Department of Commerce. The industry representatives were told to expect conservation orders prohibiting the use of copper and aluminum for certain purposes and curtailing their use in other products. At present the only prohibition on usage of copper and aluminum affecting this industry is the ban on their use for ornamental or decorative purposes.

• Production of pumps for the first quarter of 1952 has been set at 125% of the average quarterly production in 1947, the National Production Authority, U. S. Department of Commerce, announced at an October meeting with the industry's advisory committee. The committee proposed that a task force be named to report on production figures for 1947 after some members protested that the data for that year failed to include all the controlled materials used in their products. An NPA official said he would urge reconsideration of the pump program if facts are offered to substantiate it.

• Authorized compressor production during the first quarter of 1952 is now planned at 125% of average quarterly production in 1947, the National Production Authority, U. S. Department of Commerce, announced at a meeting with the manufacturers' industry advisory committee. NPA explained that this authorized level would be similar to the production level in the first quarter of 1951.

• Construction has started on a new heating plant to serve the National Tube Company's Fairless Steel Works, according to an announcement by The H. K. Ferguson Co., industrial engineers and builders. Scheduled for completion in April, 1952, the plant will furnish steam for the process as well as the buildings. The plant will have two boilers, each with a capacity of 85,000 pounds of steam per hour. Any of four fuels can be burned under the boilers, including coke breeze, coal, coke oven gas or fuel oil. Each fuel can be burned alone or the solid fuel may be burned in combination with either gas or coke oven gas.

• The nomination of Ernest Szekely, president of the Bayley Blower Co., Milwaukee, Wis., for president of The American Society of Heating and Ventilating Engineers in 1952 has been announced. Nominees for other offices submitted by the ASHVE nominating committee are: First vice president, Reg F. Taylor, consulting engineer of Houston, Tex.; second vice president, L. N. Hunter, vice president of research, National Radiator Co., Johnstown, Pa.; treasurer, J. Donald Kroeker, consulting engineer, Portland, Ore.

• The American Appraisal Co. Construction Cost Index rose 5 points during the third quarter to a new high of 536. Increased labor wages accounted for a 4-point rise in July and a 6% increase in freight rates in September added another point—or a total rise of five points for the third quarter. The American Appraisal Company Index is based upon a detailed analysis of materials and labor required for representative types of industrial building structures, repriced monthly in accordance with (1) prevailing wage scales and labor performance for the various building trades, and (2) quotations for construction materials in thirty key cities in the United States. The index assumes normal average conditions and does not give recognition to overtime or premiums paid for materials in individual cases or under temporary abnormal conditions. The index applies to construction only and does not include factors for building fixtures and decorations. The index figures are based upon 100 representing 1913 costs. The 1939 national average was 200.

• Howard W. Pound, 55, vice president and manager of the Air Filter Sales Division, American Air Filter Co., Inc., Louisville, Kentucky, died October 10. He was a graduate of Purdue University, veteran of World War I, member of ASHVE and an engineer of long experience in the air filter industry.

How to Prevent Wet Concrete Floors.

"High-heat capacity floors have a further undesirable feature in climates having abnormally high humidities, particularly in the summer. The concrete in contact with the ground is relatively cool, and frequently moisture condenses on the floor surface, damaging floor coverings.

"When the slab is insulated from the ground, its surface tends to follow air temperatures much more closely and is seldom below the temperature at which condensation begins to take place."

From "Progressive Architecture" research report: "Insulation for Concrete Floor Slabs on Grade."

Warmth in walls and ceilings flows to cold uninsulated floors, following nature's law that heat travels from warm to cold, in any direction, in conduction and radiation. The rate of radiation and absorption is over 90%. Furniture, even people, radiate heat to the colder floor, and also conduct heat down wherever they touch its colder surface.

The warmth absorbed by the floor flows down by conduction through solids to its colder under surface which radiates the heat wastefully to the ground at a rate exceeding 90%.

Multiple sheets of accordion aluminum *underneath* the floor reflect back 97% of radiation. The air spaces restrict heat flow by conduction to 5%. There is no such thing as convection downward. With practically no heat loss, the concrete *"tends to follow air temperatures"* and remains above dew-point.

Moreover, multiple accordion aluminum has zero vapor permeability. It remains permanently in place, is cheaply installed without the need of expensive support, and does not tear where stapled because it weighs but 1 oz. to the sq. ft. and is moisture-proof and non-condensation-forming.

TECHNIQUE FOR INSULATING CONCRETE FLOORS

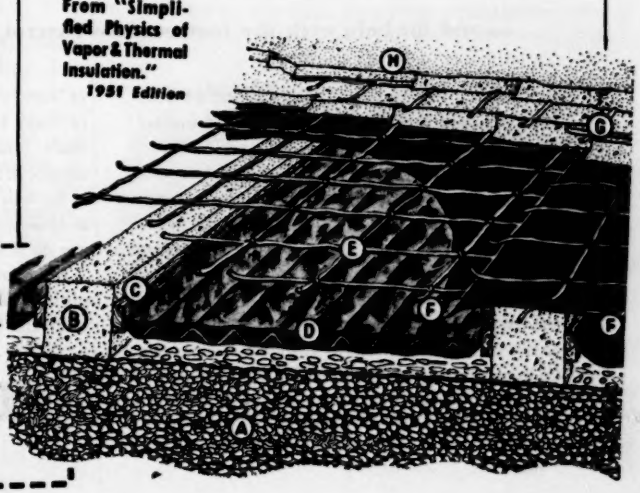
Installed over rolled gravel (A), for residences; over appropriate 4", 5", 6", etc. cement slab for factories, warehouses, hangars, etc.

(1) On 16" centers make appropriate forms for concrete joists (B), 3"x3", 4"x3", 4"x5" etc. **(2)** Pour concrete joists **(3)** After concrete sets semi-hard, **(4)** nail wood lattice or furring strips (C), **(5)** to sides of concrete joists and **(6)** staple Infra insulation (D) to them **(7)** with at least 1" space from top of concrete joist.

(8) Over concrete joists place asphalt-paper-backed welded wire mesh (E) (3"x3", or 3"x6", or 6"x6"), paper facing down, mesh facing up. **(9)** Lap *at least* 6" (F) **(10)** Mop lap with waterproofing to prevent concrete while liquid from leaking through. **(11)** Now lay down a plain welded wire mesh (G) 6"x6", No. 10 gauge, no paper attached. **(12)** Pour concrete (H) to desired thickness. While pouring concrete, lift free wire mesh with hooks a few inches.

NOTE: It is advisable to drive the nails through the furring strips before applying them to the concrete joists.

From "Simplified Physics of Vapor & Thermal Insulation." 1951 Edition



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—and for help with the temperature control, we'll talk to Honeywell!

It's plain to see cartoonist Sam Cobean's wacky characters have their own ideas on how to inspect a home.

But in *one* thing, at least, they're like everyone else—they place a high value on comfort. Moreover, they know you can't have real comfort without proper temperature control. And they know where to go for help with *that.*

Honeywell *can* help heating engineers and contractors provide the proper thermal environment for any client—anywhere—in any kind of structure. We have a lot of well informed control engineers—in our 91 different offices—who are experienced in doing just that. And we have a lot of literature that's yours for the asking—on the automatic control of heating, ventilating and air conditioning.

So, why not *talk to Honeywell?* Why not *write to Honeywell* about *your* control problem? And why not do it *now?*

For more information on how the Honeywell organization can help you solve your control problems, see the column across the page.

MINNEAPOLIS **Honeywell**

First in Controls

• Albert R. Mumford, research engineer for Combustion Engineering-Superheater, Inc., received the Percy Nicholls' Award on October 11 at the fourteenth annual joint fuels conference sponsored by the Fuels Division of the ASME and the Coal Division of the AIMME. The award was established in 1942 to recognize notable scientific or industrial achievement in the field of solid fuels.

• Retail coal dealers, numbering about 18,000 throughout the country, have been authorized by the Office of Price Stablization to pass on to consumers the full freight rate increase on coal, amounting to a maximum of 20 cents per net ton, approved by the Interstate Commerce Commission on August 8, 1951. However, OPS points out, its new amendment merely permits retail ceiling price increases based entirely on actual advances in freight charges, and does not increase retail dealers' margins.

• Arthur H. Sy, formerly sales manager, has been named vice president in charge of sales for American District Steam Co., Inc., North Tonawanda, N. Y. Mr. Sy has been with the company since 1923, serving in various capacities in production, engineering and sales, becoming sales manager in 1946.

• Oil-Heat Institute of America has announced that the 29th Anniversary Exhibition of the automatic oil-heat industry will be held at the Commercial Museum in Philadelphia, April 14th through April 18th, 1952. This will be the largest industry exhibition ever sponsored by the Institute. The 29th Annual Convention will be held concurrently, with headquarters at the Benjamin Franklin Hotel.

• Authorization to increase ceiling prices so as to reflect recent increased transportation costs has been granted by the Office of Price Stabilization to tidewater coal dock dealers. This will have the effect of adding 47 cents to the gross ton price.

• William H. Sisson has been named power industry manager for Minneapolis-Honeywell Regulator Co. Mr. Sisson, now industrial manager of the company's Indianapolis office, will promote product sales in the central station and power fields. He will make his headquarters at Philadelphia. George M. Rossiter is being transferred from the Milwaukee office to Indianapolis where he will become industrial manager, succeeding Mr. Sisson.

• A six-sided "hex tent" now being shipped to Korea represents last word in refinement of the World War II model pup tent. Each tent shelters five men in comfort at temperatures down to 95 degrees below freezing. The tents resemble tepees, with ground cloth to keep out cold wind, seal in warm air provided by small gasoline Yukon stove. Light aluminum tent pegs and telescoping center pole help keep over-all weight down to 56 pounds.

For help with any control problem, talk to MINNEAPOLIS Honeywell

Consult your nationwide "Honeywell Staff"

In planning schools, factories, offices and other large buildings no doubt you often run into this problem:

What's the best way to get coordinated technical help with a multitude of control systems—for temperature, ventilation, air conditioning, refrigeration, industrial process?

The answer is simple:

Call your local Honeywell representative.

He can give you unbiased advice on equipment, because he has a complete line of controls—pneumatic, electric, electronic. And to help you meet special problems, he can bring in specialists from one of 91 Honeywell offices.

When you *standardize on Honeywell*, all control applications can be treated as one project. And you'll be designing an integrated system that can be serviced and adjusted simply by consulting one company. The Honeywell service organization—with its wide scope and flexibility—is positive assurance that your controls will perform efficiently for a lifetime.

So from now on, plan to standardize on Honeywell. And call in your local Honeywell representative often. He's the key man on your nationwide "Honeywell Staff."

Send for your personalized cartoon

. . . and for help with the temperature control, we'll talk to (your firm name).

For your personalized, free 8¼" x 9" reproduction of this Cobean cartoon, write to Honeywell, Dept. HV-11-208, Minneapolis 8, Minnesota.

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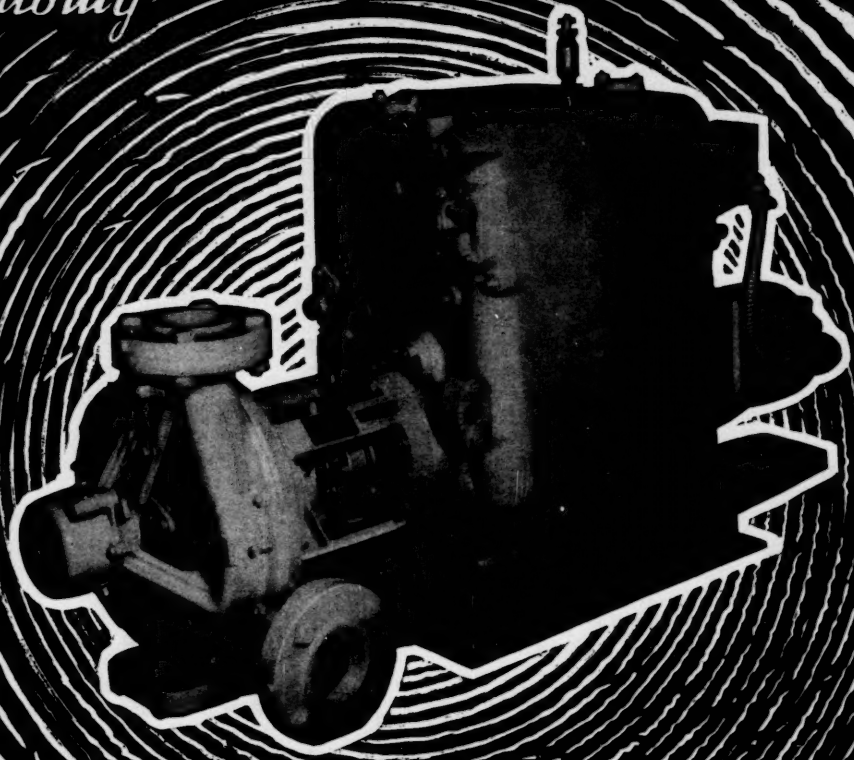

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CONTROL OF DISCHARGE PRESSURES PREVENTS REFRIGERATION TROUBLES

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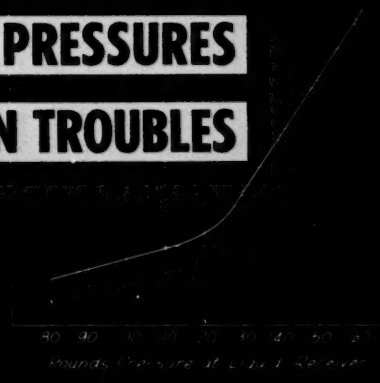


Fig. 1

Evaporative condensers and cooling towers produce a discharge pressure fluctuation that is universally troublesome, especially with flooded or semi-flooded low sides. Various methods of control are available to maintain system stability, and the one to use can only be determined after careful study. What these methods of control are and how to apply them are discussed in this article.

WHEN considering the effects of varying head pressure on refrigeration cycle operation, the assumption is made that the normal design or peak season operating discharge pressure is of the order of 120 to 140 lb per sq in., and that the variations from this in fall and spring, or on a cool day, will represent decreases in head pressure that may be of appreciable value. Most of the effects observed as a result are adverse in their relation to desired system operation.

First, and perhaps most obviously, the expansion valve capacity may be materially decreased so there will be a tendency for insufficient refrigerant to be delivered to the evaporator. For example, design conditions of 130 lb per sq in. head pressure, in cool weather may be reduced to as low as 90 lb per sq in. With a relatively constant load, the suction pressure originally at 37 lb per sq in. may drop to around 31.5 lb per sq in. with the lowered head pressure. Reference to any standard thermostatic expansion valve capacity chart will indicate that a valve properly selected for the foregoing head and suction pressures will experience a drop of some 24% in tonnage capacity, as a direct result of the decrease in pressure differential across the valve that in turn is caused by the lower operating head pressure. The resulting effect will be the same as having an expansion valve too small by this percentage which means insufficient refrigerant available for the cooling coil and poor valve control characteristics. While the corresponding decrease in suction pressure, caused by greater pumping capacity at the lowered head pressure, will mitigate the drop in differential across the valve, it cannot fully compensate for it. Under certain conditions, it might have the adverse effect of causing coil frosting.

With certain types of heat loads, where the mild outdoor condition will automatically appreciably reduce the load on the system, this result may not be too serious as a decrease in the space load will tend to compensate for the decrease in expansion valve capacity. This is not true for process installations where the load remains constant, and where there can only result a definite shortage-in-refrigeration effect of such a degree that it may seriously interfere with the processes being controlled.

It might be argued that the drop in capacity in the expansion valve that brought about a lowering of suction pressure, would automatically tend to correct the condition to a certain extent. This would, in turn, result in an increase in the pressure differential across the expansion valve. To a limited extent, this would be true and might reduce the harmful effect, but at best it would throw the system out of balance and result in erratic operation as well as reduced capacity. An unfavorable secondary effect is the possibility of maldistribution of the refrigerant through the direct expansion coil distributor, as this requires loading at about full capacity in order to maintain proper distribution.

The second undesirable effect of a materially decreased discharge pressure is a greater tendency for gassing at the expansion valve in those installations where the expansion valve is located at an appreciable height above the liquid receiver. Fig. 1 shows the relationship, in a typical system, between the vertical location of the expansion valve in feet above the liquid receiver and the head pressure at the liquid receiver. It indicates the maximum vertical value in a typical

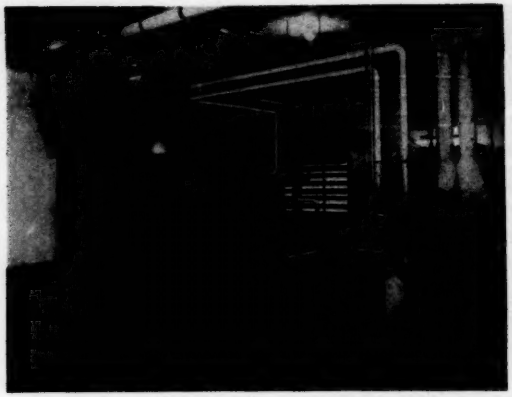


Fig. 2. Evaporative condenser system with head pressure control cycling pump. Arrow indicates the control.

liquid line to avoid gassing at various head pressures.

Average, but not excessive pressure losses in horizontal pipe and fittings are taken into account. Data are based on a 95F ambient temperature and 10F subcooling at the receiver outlet.

It is readily apparent from this curve that a decrease in head pressure from 130 to 90 lb per sq in, will reduce the vertical rise which can be handled without gassing at the expansion valve, from 44 to 25 ft. Once gassing occurs, the capacity of the system is appreciably reduced, for it is closely related to expansion valve performance effect as mentioned. In either case, if an attempt is made to restore full capacity by oversizing the expansion valve, poor control will frequently result, because of the tendency of an oversized expansion valve to hunt at light loads. If the particular system under consideration is critically charged, the reduced capacity effect may be somewhat counteracted by increased sub-cooling effect in the bottom passes of the evaporative condenser at the lower pressure.

A word of explanation may be in order with regard to the break in the curve of Fig. 1. The changing slope of the curve is caused by selection of the arbitrary figure of 95F ambient temperature, corresponding roughly to 123 lb per sq in. saturation pressure. Below this value, the liquid refrigerant line will absorb heat from the surrounding atmosphere which will tend to dissipate the sub-cooling effect in addition to the factors of friction loss and increase in vertical head. Above 123 lb per sq in., heat will be lost from the liquid line to the surrounding atmosphere, which will thus increase the sub-cooling effect and will materially increase the height of the column of liquid Freon that will be supported by the existing head pressure. Thus, above this point it is about equivalent to translating the head pressure to the equivalent static head in feet of the liquid, since radiation from the line above room temperature will tend to compensate for the friction loss in the pipe.

A third adverse effect of a sharply decreasing head pressure in mild weather conditions occurs on systems employing flooded or semi-flooded low sides where appreciable quantities of liquid refrigerant may return to the compressor crankcase, causing slugging and perhaps loss of oil pressure. Manufacturer's recommendations for such systems almost always specify a liquid-to-suction heat exchanger. The purpose of this heat exchanger is two-fold: (1) to adequately superheat or dry up the suction gas to avoid damage to the compressor (which would be experienced if refrigerant liquid was brought back in any quantity in the suction line); (2) to obtain useful work for the entire water cooler transfer surface rather than utilizing an appreciable portion of it simply as a suction gas dryer. The over-all system performance is also improved by the use of the heat exchanger. The heat exchanger surface is normally sized based upon the design operating conditions of the system in which the head pressure or liquid temperature is one of the important factors. If this pressure decreases appreciably below the design point, the heat transfer within the heat exchanger will be severely reduced to the point that an appreciable amount of refrigerant liquid may return to the crankcase where it may readily cause damage to head valves from slugging and also there may be serious lubrication problems.

Case Histories of Varying Pressure

An interesting example of this effect was afforded by an installation where there was considerable flexibility in the condenser piping. In this installation, the head pressure could be varied by changing the condenser valving arrangement served by the cooling tower, and thus vary the discharge pressure without making any other changes in system operation. This particular system was cycling back and forth from the condition of 50 to 100% loading at 5- to 6-minute intervals, with the head pressure varying from 105 lb per sq in. at 100% loading to 90 lb per sq in. at 50% loading. The condensing effect was then increased by opening valves so that the head pressure fluctuated between 100 lb per sq in. on 100% loading, and 88 lb per sq in. on 50% loading. This reduction in head pressure of only 5 lb per sq in. was sufficient to reduce the oil pressure so that it was less than 10 lb per sq in. above suction pressure. Thus the machine stopped on the automatic oil pressure safety device shortly after it again cycled onto the 100% loading condition. Suction pressures corresponding to these figures were 36 and 30, respectively, for the 90 and 105 lb per sq in. head pressure conditions, and 35 and 30 for the 88 and 100 lb per sq in. head pressure conditions, thus indicating a constant semi-flooded evaporator load.

This particular unit was apparently operating close to the minimum safe head pressure point to start with so that the heat exchanger was just barely drying up the refrigerant gas returning to the crankcase. When the pressure was dropped a few pounds, as indicated, the additional drop in heat exchanger transfer effect was enough to allow liquid refrigerant to return to the crankcase in sufficient quantity to dilute the oil and lower the forced lubrication oil pressure to an unsafe value. When the head pressure was again

raised by throttling the water to the condenser, the oil pressure returned to a safe value.

To show what can happen in an extreme case of low head pressure, another case history is cited. In this particular case, the evaporative condenser, and also the liquid receiver, were located outside on the roof and the system was required to operate during the winter. This location was subject to extreme temperatures during the winter season, and on this particular day the outside temperature was 0F. The liquid refrigerant in the receiver, therefore, was at this same temperature after a weekend shutdown. When an attempt was made to start the system the following Monday morning, the temperature of the liquid Freon was so cold that the freeze protection controls on the indoor water cooler were actuated almost immediately from this cause.

Reduced Head Pressure

The normal fluctuations in head pressure produced by partially unloading the compressor have been noted. On certain types of systems, the opposite effect may occur whereby the unloading is directly affected by the decrease in head pressure during mild weather. This situation develops in compressors that use discharge pressure to furnish the operating means for unloading, together with a piston-actuated plunger to depress the valve reeds and hold them in the open position. This device basically requires a relatively large pressure differential to operate the unloader piston. When the head pressure decreases to as low as 90 lb per sq in., there may be insufficient pressure to provide positive operation of the unloader. As a result, the unloader tends to pulsate or chatter. If this situation continues, it may result in severe damage to both the unloader and the valve reed assemblies.

The only favorable result of reduced head pressure under mild outside conditions is small indeed, compared to the many adverse factors already covered. However, there will obviously be a slight decrease in the electrical power required when running at the lower head pressure, and there will also be a small increase in the refrigerant pumping rate (both of these on the assumption of a constant suction pressure load) which will result in an over-all gain in the coefficient of performance (Btu output per kilowatt hour).

Influence on Oil Return

As stated initially, seasonal reduction in head pressure is of particular importance on water cooler systems of the flooded or semi-flooded type. In addition to the adverse effects of low head pressure on crankcase lubrication, there are others that stem from the reduced amount of heat interchange that occurs where an expansion valve or other type of element is employed that depends on suction line superheat for its control. Since the function of the superheat control device is to maintain as nearly as possible a positive superheat, an attempt must be made to provide it elsewhere in the system when such superheat is not provided in the heat exchanger by the heat of the liquid. This means that the level of the boiling liquid

Fig. 3. Automatic three-way valve by-passes sprays to maintain constant head pressure.

in the evaporator will be reduced. Due to the relatively low temperature differential between the water inlet temperature and the refrigerant temperature, this reduction in evaporator liquid level may be very appreciable. Because the heat transfer efficiency of flooded and semi-flooded coolers depends on having the entire evaporator filled with violently boiling liquid, any reduction in liquid level in the refrigerant circuit of the cooler will result in a materially reduced capacity. In turn, this will produce other adverse effects, such as difficulty of obtaining oil return.

This oil return is dependent on the agitated boiling mixture of Freon gas and oil being close to the top of the cooler and actually being at the point of "slopping over," with any entrained liquid Freon particles normally to be taken care of by evaporation in the heat exchanger. With the superheat taking place in the top of the evaporator, the remaining portion of the evaporator tends to become a giant-sized oil trap rather than a device that will readily return oil. This condition can continue to the point that all of the oil is lost from the crankcase to the evaporator and the only way to get it back is through a special bleedback line, with or without a still to boil the Freon from the oil.

When oil tends to lie in the evaporator, it immediately develops an important secondary effect of further limiting the capacity because of the decreased heat transfer of the boiling Freon mixture in the evaporator when it is heavily commingled with oil. Instead of having an evaporator full of violently boiling Freon liquid and gas mixed with oil droplets that are continuously drawn off at the top through the suction line back to the compressor, we tend to have a partially filled evaporator with a sluggish mass of slowly boiling liquid Freon admixed with a heavy concentration of oil. The effect is cumulative and may reach the point where the system will simply not develop anywhere near its rated capacity. Thus, under extreme and most adverse conditions, there may develop a condition of extreme loss of capacity and also physical loss of oil from the crankcase. The situation, of course, is worse under conditions of light load when

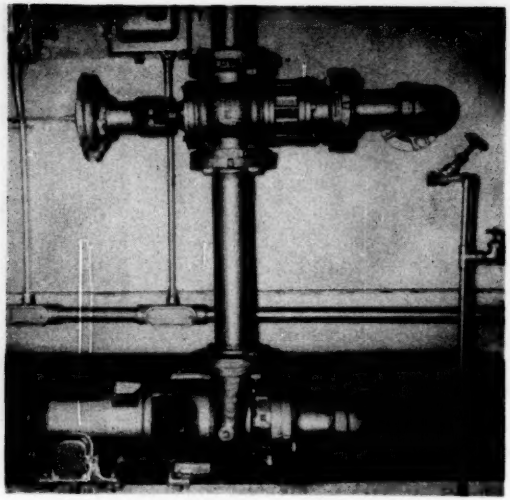


Fig. 4. Close-up of three-way pneumatically controlled by-pass valve.

the compressor may be operating at partial capacity, with reduced gas velocity throughout the system.

How to Control Head Pressure

There are several methods of control available and some possess greater degrees of refinement than others. In describing these, an effort will be made to list relative advantages and disadvantages and to select those which are believed most desirable from an over-all standpoint. At the same time, it is recognized that there are many jobs operating satisfactorily on any of the commonly accepted methods of head pressure control, and the final selection will be based on individual preference, together with the particular operating characteristics of the job under study. Typical installation examples of most of the various methods will be given.

The simplest and least expensive control to employ is a simple discharge pressure control arranged to start and stop the water pump of the evaporator condenser in response to head pressure. A typical installation using this method on a 100-ton system is illustrated in Fig. 2. The head pressure control is located on the rear of the compressor, as indicated by an arrow. This control is set so the evaporative condenser water pump is shut off when the head pressure drops to approximately 100 lb per sq in. It will cut back "on" automatically when the head pressure builds up to approximately 125 lb per sq in. Use of an electrical type of control is usually preferable with this method. As indicated, the cycling of the water pump on head pressure is the simplest and probably the cheapest method of control. The cost of the control for the system indicated in Fig. 2, for example, is of the order of $12 to $15. In many cases, this type of control will produce results that are entirely satisfactory.

There are, however, several disadvantages to this method that will be readily appreciated. To avoid short cycling of the water pump, it is necessary to maintain a fairly high differential in the control switch. Also these switches are built with a relatively large differential, unless a special design is specified. These two factors result in a wide swing control instead of gradual control that is accentuated by the time lag created by the wetted surface of the coil. As a result, the head pressure will frequently overshoot after the pump is shut off on the down swing of pressure, and will then build up slowly as the coil surface dries until the cut-in point is reached. At the cut-in point, it will drop rapidly as the sprays come on, and as the condenser changes over from dry to wet type of operation. With the system shown in Fig. 2, the overshooting did not exceed 5 lb per sq in., and the operation was entirely acceptable. On some installations, the overshooting in a downward direction may run appreciably higher than this.

In addition to the lack of a closely controlled pressure result, the constant wetting and drying of the evaporator coil surface tends to collect solids on the coil, and over a period of time may result in incrustation at an accelerated rate. Most coil manufacturers design their coils for continuous flooding to minimize this condition; changing the operating cycle will adversely affect the result. An important disadvantage is the possibility of decreased life of motor and starter, owing to starting and stopping much more frequently than normal duty requires.

Another simplified method of control that has many of the same characteristics as the cycling of the water pump is to cycle the evaporative condenser fans, again on a simple on-off head pressure controller. This method has about the same advantages and disadvantages as the preceding control scheme except that in addition, it may shorten belt life appreciably from frequent starting and stopping.

Some contractors make it their practice to use either cycling of the water pump or cycling of the evaporative condenser fans to control head pressure, whichever gives the better results. Field reports have indicated that one of these methods may give better control on some jobs than the other. In some cases, this has occurred even on two separate installations in the same plant.

In one case where an evaporative condenser system was required to operate during extremely cold periods, it was found necessary to use both the previous controls in conjunction with one another. The controls were arranged so that if the head pressure drops to 122 lb per sq in., the fans stop. If pressure drops to 110 lb per sq in., the pump shuts off. There was a reported overshooting of the head pressure on the way down of about 10 lb per sq in. after the cut-out had stopped the water pump and while the coil surface was drying. In the reverse direction, as the head pressure increases, the pump starts when the discharge exceeds 120 lb per sq in., and if it continues to increase, the fans start when pressure reaches 132 lb per sq in. Both fan and pump operate above this point.

In actual operation, it turns out that the principal method of control is by cycling the fan, with the pump going off only in extremely cold weather. Despite this

fact, it is stated that there is no noticeable belt wear in one full year of operation. This combined method of control requires two pressure-actuated controllers with the operating points adjusted differently, as indicated.

Modulating Spray Nozzles Supply

Modulating the water circulated to the evaporative condenser spray nozzles by a 3-way valve which by-passes a certain amount of water back to the sump without passing through the nozzles, is a means of smoothing out the wide swings of head pressure. Since this system requires more control equipment than the others, it is more costly.

A typical example of a 100-ton installation of this type is shown in Fig. 3. A close-up of the modulating 3-way valve is shown in Fig. 4. This is quite a satisfactory arrangement from the standpoint of maintaining a relatively constant head pressure, as this particular installation held very readily 120 lb per sq in. ± 5 lb. The control equipment involves a pneumatic pressure regulator and a 3-way 3-inch flanged by-pass valve, the total cost of which is roughly $175.

Where the economics of the installation will permit, this is a satisfactory way of maintaining head pressure through a modulating control. It has the disadvantages of relatively high first cost and there is a tendency for increased scaling or incrustation of the coil because of water flow which may be materially below design values, during the time a substantial amount of water is being by-passed around the sprays back to the sump.

Control Through Air Circuit

So far we have considered measures of modulated control through the water circuit only. Similar results can be obtained by appropriate controls in the air circuit, such as an external by-pass damper. The one illustrated in Fig. 5 shows a typical installation of a 15-ton evaporative condenser with external by-pass dampers. Here the head pressure modulating control varies the opening of the by-pass damper from zero to full position, admitting air directly to the fan intake through the dampers and by-passing the condenser coil to a greater or lesser degree. This gives a very smooth operating result. This installation has operated quite satisfactorily for a number of years.

A word of caution is in order, as any fan specialist will immediately sense. By opening the external by-pass damper, the total cfm handled by the evaporative condenser fan system is immediately increased. This may impose a severe overload on the motor, depending on its initial selection point. This will be made clear by reference to Fig. 6 which is a plot of the actual performance of the forwardly-bladed fans used in the evaporator condenser illustrated in Fig. 5. By actual measurement, the total cfm handled by the fan varies from the normal figure of 3,515 with the by-pass damper closed, to the increased figure of 4,510 with the by-pass damper fully opened. Reference to the static pressure curve of Fig. 6 will show that this represents a decrease in static head from 0.6 to 0.26 inch of water. The important thing, however, is the correspondingly sharp increase in horsepower from 0.76 to 1.01. Had the fan motor been selected without regard for reserve capacity, it would have been a ¾ hp size. Normally, this would have taken care of the installation quite well, but when the by-pass damper is opened for an extended period of time, a serious overload of some 33% would result. As this is more than the normal motor service factor of 25%, it might well result in motor burnout. In this particular installation this possibility was anticipated, and a 1 hp motor was installed on the fan.

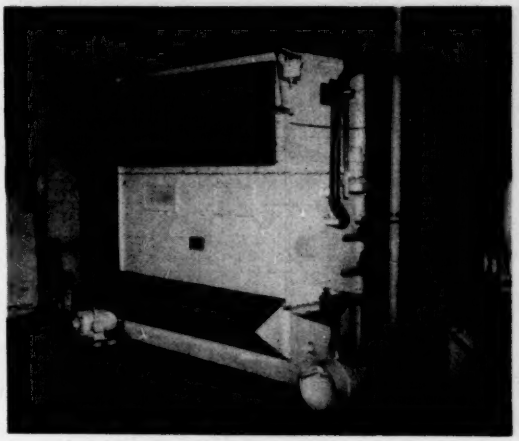


Fig. 5. External by-pass damper controls head pressure on this 15-ton installation.

Normally, the load condition on the motor would not be quite this severe, as the damper would assume a mid-position determined by its pneumatic modulating control responsive to the head pressure of the refrigerant system. This condition could be improved by (1) properly sizing the damper so it would not unduly decrease the static pressure even in its full open position, or (2) by installing a maximum opening limit control on the damper. In either case, the maximum open position would represent a fixed orifice by-pass usually sufficient to insure adequate head pressure.

The external by-pass damper method can be regarded as acceptable, with the limitation outlined, but the cost of the damper and pneumatic operating motor, together with the increased motor rating which may be required, make the cost appreciable. The damper shown in Fig. 5 and its controls cost about $100.

An internal by-pass damper construction can be similarly employed, but it involves increased space requirements, and is quite difficult to incorporate after the installation has been completed. Actually, instead of a by-pass arrangement, the internal method of control is usually based on the partial recirculation of the discharge air back through the coil. It obtains its capacity reduction by feeding warm, humid air back to the condenser, rather than reducing the air flow through the coil. This avoids the possibility of overloading the fan motor as the system static pressure is not altered appreciably; it has an advantage where the

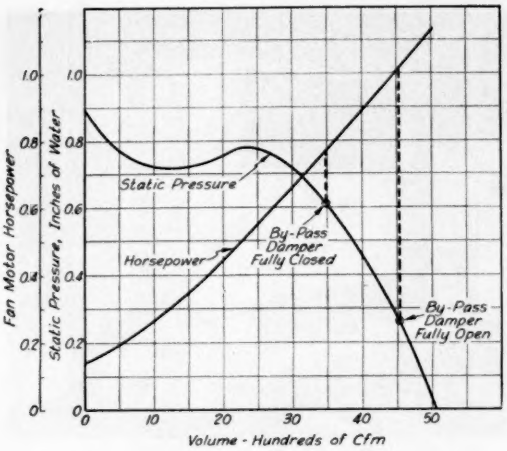


Fig. 6. Characteristic curve for forwardly-bladed evaporative condenser fan.

system is expected to operate for extended periods in very cold weather. The plan usually involves an interlocked damper system controlling inlet, outlet, and bypass ducts.

A simple outlet damper is satisfactory, from an operational standpoint, for cutting down the air flow over the condenser coil. Resistance is introduced in the outlet air stream, and the head pressure is thus kept constant. However, its location in the hot, saturated outlet air stream may make maintenance high.

The inlet method of damper control, as illustrated in Fig. 7, will probably be found to be more satisfactory for universal application to various jobs than any other of the methods indicated, despite its substantial cost. Fig. 7 shows one of the dual air inlets with the damper in a fully closed position on a Westinghouse 75-ton evaporative condenser. In the large sizes, evaporative condensers frequently have two separate air inlets, one on each side. Both of these must be equipped with dampers to obtain positive control, although only a single pneumatic regulating valve is required. Actual damper and control costs for the 75-ton installation shown in Fig. 7 were just over $200. A factor which should be taken into account is the necessity for maintaining access to the sump for seasonal servicing. A convenient way to do this is by hinging the entire damper assembly so it can be swung out after disconnecting the pneumatic motor damper operating arm. Operation with the inlet damper control is reported as eminently satisfactory, and there is an appreciable fan motor horsepower reduction at reduced air flows as will be evident from reference to Fig. 6.

Many times, two or more evaporative condensers connected in parallel are arranged to serve a very large refrigeration system. For effective inlet damper head pressure control with such an arrangement, it requires as many sets of dampers and separate discharge pressure controls as there are evaporative condensers. Either of the controls will modulate the dampers, and all must be satisfied as to the high value setting of head pressure for all dampers to be fully opened. It is customary in such cases to set the head pressure controls at slightly different values so they operate on a step principle to avoid excessive operation of the dampers. To maintain proper system balance, the head pressure controls should not be set so wide apart that the dampers on one unit close fully before the other set begins to close.

Air inlet dampers are particularly well adapted to certain types of horizontal air flow evaporative condensers using an axial flow type of fan. Damping devices of the vane control type are especially suitable in this case since they permit a reduction of air flow

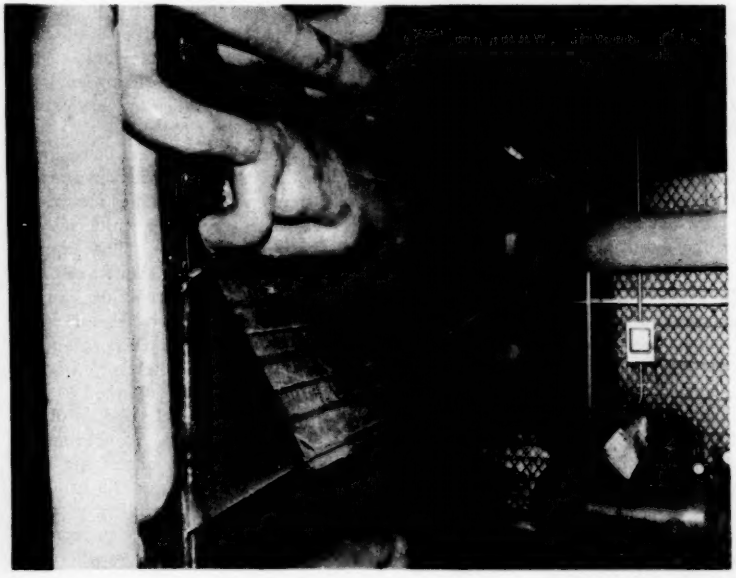


Fig. 7. A 75-ton damper head pressure control in fully closed position at All Steel Equipment Co., Aurora, Ill. Installing contractor — Chicago Conditionaire Co.

over a wide range with a corresponding reduction in motor horsepower.

Cooling Towers

Although this article is primarily concerned with evaporative condenser head pressure, a similar problem of control arises in the application of cooling towers. If sufficient pumping head is available, the standard water regulating valve may be employed to control the flow through the condenser, but this is not usually the case. If a water regulating valve is used, it may also require a by-pass around the condenser coils which would be adjusted to a fixed point for spring and fall operation, and left entirely closed during peak load operation in the summer.

Another method, as illustrated schematically in Fig. 8, is to install a motorized two-way modulating valve to by-pass the unneeded cooling water around the condenser and at the same time to maintain both a fairly constant head on the pump, and a constant water flow through the nozzles. The modulating valve in this case can be controlled by a pressure control, or by an inlet or outlet water temperature control as desired. It is usually desirable to incorporate the by-pass around the condenser rather than around the cooling tower sprays, as performance of the tower depends critically on the pattern of sprays in many tower designs, and any by-passing of the spray nozzles may excessively reduce the performance. A reverse-acting

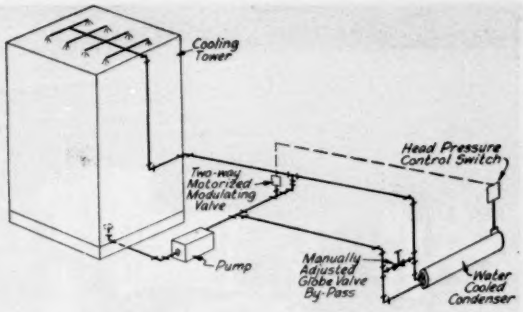


Fig. 8. Schematic arrangement showing automatic water-cooled condenser by-pass for maintaining head pressure on cooling tower system.

water regulating valve could be used for automatic by-passing in place of the motorized valve, probably with some cost saving.

Control of head pressure by adjusting the amount of air delivered to the tower in the case of a forced-Fig. 8, is to install a motorized two-way modulating air cooling tower is, of course, a practical means of regulation. In many cases, the tower fan motors are specified to be of multi-speed construction, which provides a simple and effective method of head pressure control.

Questions Often Asked About Snow Melting

At what temperature should circulating water used in a snow melting system be maintained?

This is one of the questions most frequently posed by contractors concerning the growingly popular subject of snow melting, according to A. M. Byers Company, Pittsburgh.

The answer to this question, as it appears in a technical data letter issued by the Company, is that when the pipe is located in a six-inch concrete slab, a water temperature of approximately 140F is usually satisfactory. Where the pipe is not embedded in the concrete slab, but is placed in the fill underneath, a higher temperature is needed. It may be approximately 160 to 170F.

Other most frequently asked questions, and their answers, are as follows:

Q. May the pipe be embedded in a bituminous mix, instead of concrete?

A. Yes. The assumption that hot pipes might soften the mix is not warranted, since the slab will undoubtedly undergo even higher temperatures when exposed to the summer sun. It should be noted, however, that a bituminous material does not have as high a heat transmission factor as concrete, so that complete snow clearance calls for spacing of pipes no more than 12 inches apart.

Q. When the pipe is embedded, what is the necessary slab thickness?

A. With a bituminous slab, it is recommended that at least two inches of surfacing be over the pipe. Where heavy loads are anticipated, three inches or more is recommended. Concrete slabs should have at least two and a half inches over the top of the pipe. This will minimize the formation of hairline cracks. It will also result in a more even heat transfer to the surface. It is suggested that a minimum of one inch of material be allowed below the pipes, whether the material is concrete or a bituminous mix.

Q. Is an antifreeze solution necessary?

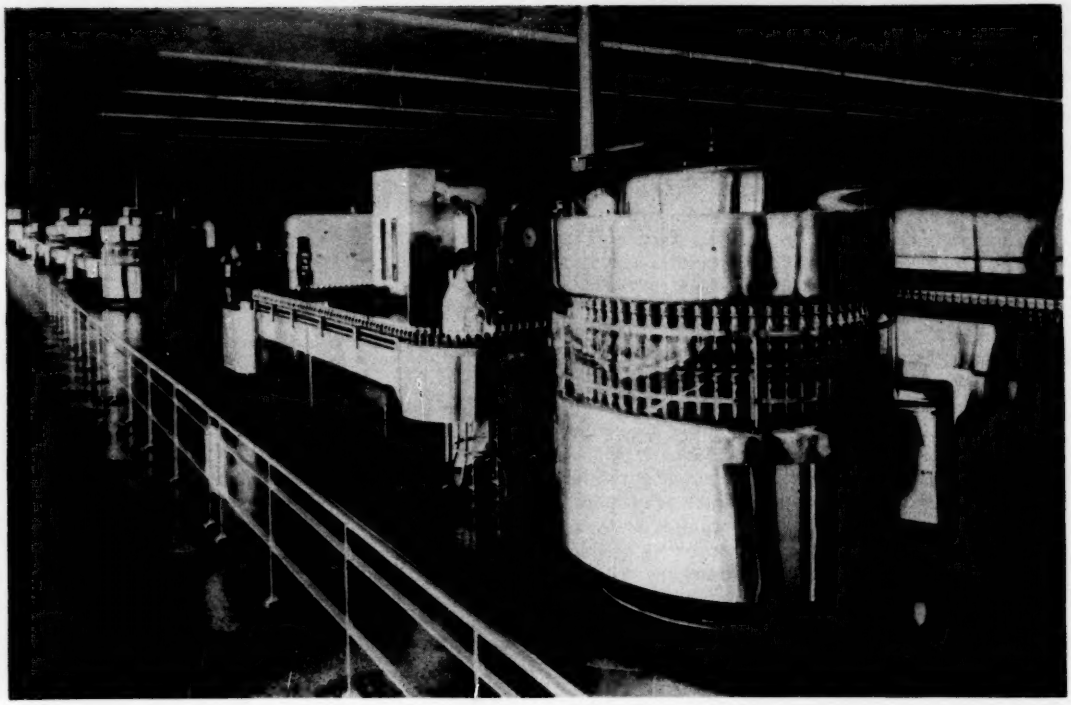
A. Some means should be employed to keep the heating medium from freezing when the system is not in operation. A 40% solution of a permanent-type (ethylene glycol base) antifreeze and water is suggested to prevent freezing. There is an increasing use of light oils to replace the water-ethylene glycol solutions, but not too much is known about their performance over a long period of time.

Q. How much fill is necessary below the slab, and what type is recommended?

A. This varies, but under normal conditions 4-6 inches of fill should be sufficient. Where ground conditions do not permit good drainage, or where there is a high water table, a deeper fill should be used. Fill should be of crushed stone, washed gravel, or similar materials. Cinders and other sulphur-bearing or acid-producing fills should be avoided.

Q. For what melting rate are most snow melting systems designed?

A. Under almost all conditions, a melting capacity of one inch of snow per hour is adequate.



Refrigeration Improves Output in Carbonated Beverage Plants

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Refrigeration in carbonated beverage plants has progressed far from the simple ice cooling cycle formerly used. Now controlled cooling of both the carbonated water and syrup speeds production and aids in quality control. Calculations of cooling load, data on equipment employed, and power and water considerations are covered in article.

PRIOR to 1913, all carbonated beverage processing was done at tap water temperatures, a procedure now termed high pressure filling. Both temperature and pressure are important, and Table 1 shows the pressure and temperatures necessary in the bottle to obtain the desired volumes of CO_2 gas when using tap water. Tests for carbonation consist of analyzing filled bottles for internal CO_2 pressure and fluid temperature, and referring to this table for CO_2 volumes.

To reduce these excessive pressures in filling, a low pressure carbonated water filler was developed which had for its prerequisite, a supply of low temperature water. Equipment to produce such water relied on a simple box-and-coil cooling cycle with ice furnishing the only refrigeration. Quantities of cold water required were small and 45F water was secured with ease.

However, with time, increased production and still lower water temperatures became realities. Mechanical refrigeration gradually supplied the answer as this refinement proved its temperature and cost advantages.

In addition to permitting lower bottling pressures during the filling operation, refrigeration provides good CO_2 gas absorption and retention in water throughout the filling process. With consistently low dispensing temperatures, it maintains beverage quality control and its corollary product standardization.

Carbonated beverage filling has two main categories: (1) low pressure filling, generally using 35F water, and (2) high pressure filling which starts at 45F water. From these basic temperatures, variations exist, as

does the method of introducing ingredients into the bottle or container.

TABLE 1—VOLUMES OF CARBON DIOXIDE REQUIRED*.

Beverage Temp., F	Bottle Pressure, Lb per Sq In.							
	0	10	20	30	40	50	60	70
32	1.7	2.9	4.0	5.2	6.3	7.4	8.6	9.7
40	1.5	2.4	3.4	4.3	5.3	6.3	7.3	8.3
50	1.2	2.0	2.8	3.6	4.4	5.2	6.0	6.8
60	1.0	1.7	2.3	3.0	3.7	4.3	5.0	5.7
70	0.9	1.4	2.0	2.5	3.1	3.7	4.2	4.8

*One "volume" of CO_2 is defined as the amount of CO_2 absorbed by one equal volume of water at 60F and atmospheric pressure. Carbonated beverages range from 1 to 5 volumes of CO_2 gas.

Low Pressure Filling

The general flow pattern in the several methods of processing carbonated beverages is shown in Fig. 1. Refrigeration is an absolute necessity if 35F water is desired. While syrup cooling and syrup room air conditioning is optional, present-day trends are for definitely controlling syrup temperatures as another aid to increased filling speeds, foam control, and an over-all quality control practice. The difference between beverage processing, with or without syrup cooling, lies in the resultant production rate and quality of the product.

The two basic ingredients of the beverage, namely, syrup and carbonated water are, in this process, introduced separately into the bottle. First a measured amount of syrup is discharged into the bottle by a syrup measuring device and then the carbonated water is added in the bottle to finish the filling operation. Bottle crowning (closure) follows immediately.

Syrup in the bottle, if at room temperature, may be 80—90F, while the carbonated water discharged on top of the syrup may be as low as 35—40F. Contact of these two ingredients at different temperatures will cause the carbonated water to release some of its CO_2. If this boiling is severe enough, it will not subside but will continue so that the entire bottle foams and loses much of its content as it leaves the filling machine. Increasing the rate at which carbonated water enters the bottle only increases this disturbance; the opposite practice of slowing up filling to allow foaming to subside reduces a normal high production rate.

Reducing the temperature difference between syrup and water, requires syrup cooling but only to such temperatures as will permit good syrup flow from the syruper into the bottle. This is usually at 60 to 70F.

Low pressure filling is usually done at filler counterpressures of 15 to 30 psig. Counterpressure is the atmosphere of air established in the carbonated water filler to control and retain the carbonation of the water. Counterpressure is established in all carbonated water filling systems (in the filling tank, filling valves and bottles), to act as a cushion and to prevent carbonation pressures of the water from being released to atmospheric pressure during the filling operation. As the water leaves the high carbonation pressures of the carbonator, pressure is necessary, whether equal to or less than carbonation pressure, to retain the CO_2 gas volumes within the water and to prevent foaming. Thus, pressure is necessary to retain CO_2 until a state of quiet or rest exists in the water. This takes place when the bottles are finally filled and are discharged from the filler. In a state of quiet, the coldness of the water is adequate to retain the CO_2 gas.

In low pressure filling, the water is first carbonated at 40 to 60 psi carbonator pressure before it is used. After saturation, the carbonation can be retained at the lower counterpressures of the filler, if the low temperatures remain constant and agitation is prevented.

High Pressure Filling

High pressure fillers operate at full carbonator pressure which approximates 35 to 75 psi. As is the

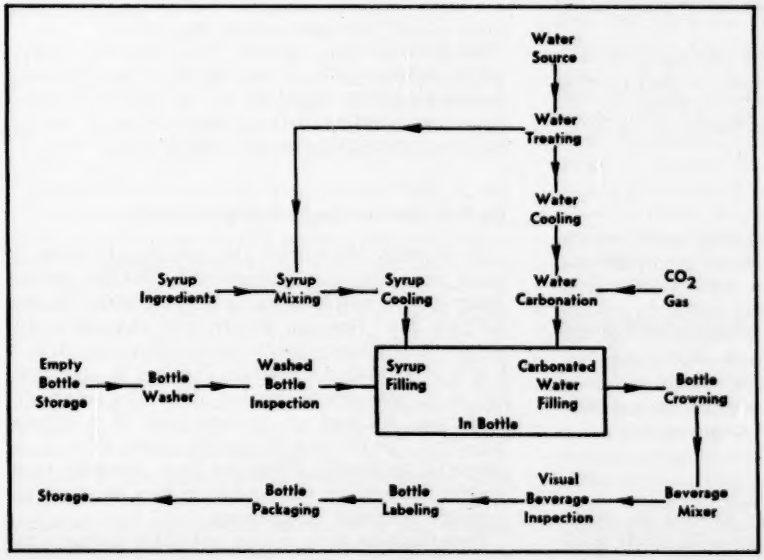

Fig. 1. Flow diagram of the various steps in the processing of carbonated beverages.

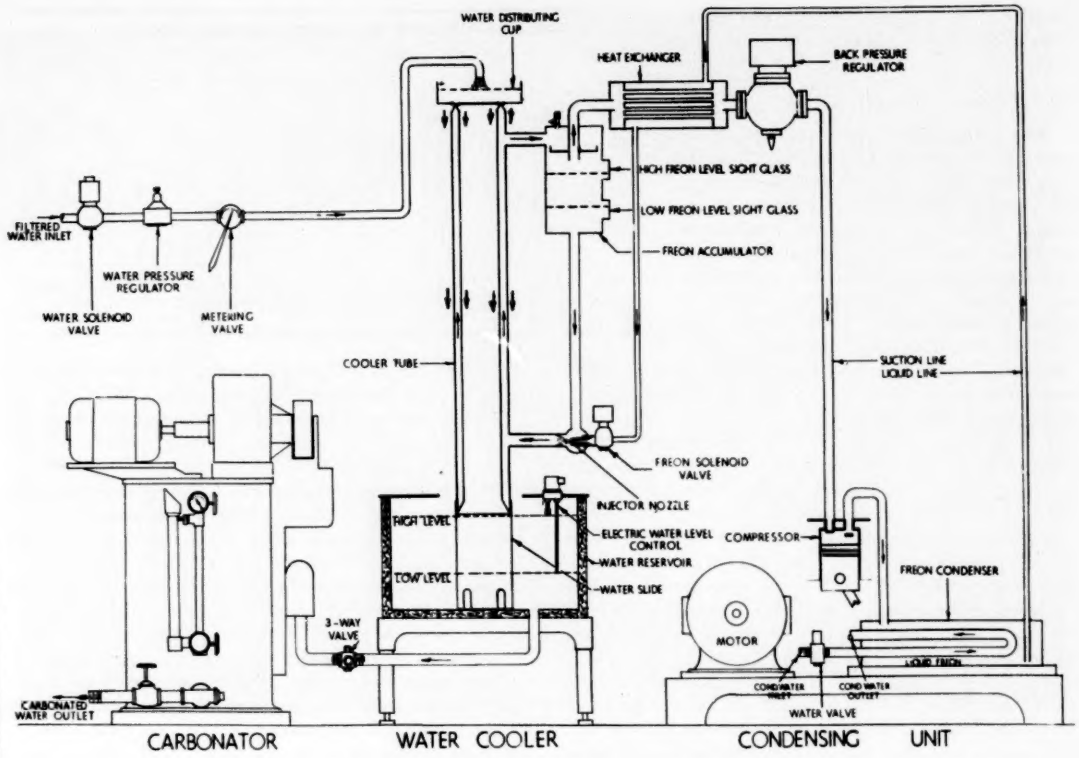

Fig. 2. Flow diagram of one type of instantaneous water cooler.

case with low pressure filling, it is varied to suit the particular type of drink being processed and its carbonation requirement. High pressure filling causes appreciably higher air beverage content than does low pressure filling. Where air, used as counterpressure in filling is at too high a pressure, it is dissolved by the beverage and becomes a problem in foam control and food oxidation.

The quality of beverage desired determines the filler application and in turn the amount of refrigeration required. Syrup cooling again is optional but the degree of quality desired by the bottler is the determining factor.

Premix High Pressure Filling

In this variation from the preceding processes, the syrup and filtered water are metered separately and then joined in a common mixture. This is followed by a combined cooling and carbonating process in a single refrigerated pressure vessel. Refrigeration in this case is the sum cooling load of both water and syrup. The combined water-syrup mix is usually cooled by refrigeration to 35 to 45F with carbonation and filler pressures ranging from 45 to 65 lb per sq in.

Plant Layout and Flow Factors

New plant design is every day proving its worth over the plan to reconvert buildings or old single space occupancy. In utilizing one large floor space, it is quite feasible to locate any and all machinery, as product flow dictates, next to any other machine unit. However, the best practice in terms of refrigeration calls for syrup mixing, cooling and general handling to be located in a sanitary room of its own. If possible, the water cooler is included. Refrigerant condensing units should be located outside this room.

Water and syrup cooling, thus isolated, insures product purity, and pipe line insulation prevents temperature losses on long runs. Water and syrup coolers may be located close to the hot bottle washers without fear of adding any appreciable thermal load.

Central Unit vs Single Refrigeration Systems

As in many other fields, the question of central vs single units has again been debated. The time-proven design favors individual refrigeration systems for each bottling line. One can realize how wasteful is the operation of a large central system where only 1, 2, 3, 4 or 5 of a total of 6 bottling lines are in operation, for, in all beverage processing, the entire scheme of production is based on bottling lines of a definite capacity. The increase of capacity comes with an increase in the number of bottling lines. Economy in all quarters determines such policy, as does the quest for complete flexibility of operation.

Instantaneous syrup cooling and water cooling is the

universal practice and best lends itself to unit operation and control.

Water Cooling

Water cooling in the carbonated beverage plant is primarily applied to cooling water for use in the bottling of the beverage itself. In some cases a portion of the water cooled may be used to cool a jacketed syrup tank in reducing the syrup temperature. In either case the cooling is instantaneous, being refrigerated from the water's initial warm temperature to the final filling temperature by a single pass over or through a refrigerated evaporator.

Refrigeration loads depend upon the speed of the beverage filler in bottles per unit time, the size of bottle and amount of water used therein, and the initial and final water temperature T_1 and T_2. It is computed as follows:

$$\frac{\text{(Bottles/min) (oz water/bottle) 60 min}}{\text{128 oz/gal}} = \text{gph of water}$$

$$\text{(Water, gph) } (T_1 - T_2) \text{ (8.3 lb water/gal)} = \text{Btu per hr.}$$

With these formulas, the maximum values should be used—the greatest bottle filling speed, the largest of several size bottles at that speed, and the highest incoming water temperature. An allowance should be made for all water treating equipment which may precede the water cooler and cause a slight warming of the water above predicted city water temperatures. Two or three degrees rise may suffice in the calculations. Where it becomes necessary to chemically process water and allow overnight settling, a temperature approaching room values will result.

Condensing unit selections should be made with a small safety factor, and a thought for plant growth.

Syrup Cooling

Syrup prepared in the average beverage plant is by the cold process, which implies mixing syrup ingredients with water at city tap temperatures. In a small amount of cases, the syrup may be prepared by the hot process method in which case temperatures of 176 to 180F are reached.

Syrup that is mixed and sterilized at 180F, if not allowed to self cool to ambient temperatures, will require instantaneous two-step cooling, first with water down to approximately 100 to 110F, and then with refrigeration down to the desired low temperature. Although it is possible to water cool a jacketed syrup tank to near the desired temperature, the time involved, water cost and the length of time the syrup is exposed to airborne infection, may dictate two-step cooling. Syrup, because of its sensitive nature, must be handled in as sterile a way possible to prevent final beverage deterioration and spoilage. It is also essential that in the syrup cooling process, aeration must be avoided to prevent adverse effects upon flavor oxidation and carbonation variation in the finished beverage.

TABLE 2—CO, VOLUMES AND WATER COOLER TEMPERATURES FOR VARIOUS FLAVORS OF CARBONATED BEVERAGES.

Beverage	CO_2 Volumes	Water Cooler Temperature, F
Plain carbonated water	5	35
Ginger ale	4	35
Lime dry	4	35
Lemon	4	35
Club soda	4	35
All beverages used for mixers	4	35
Grapefruit	2½—4	45—35
Colas	3½	35
Cherry	3½	35
Root beer	3 —3½	35
Strawberry	3 —3½	35
Cream soda	3 —3½	35
Pineapple	2 —3½	45—35
Grape	1½—3½	50—35
Orange	1½—3½	50—35
Raspberry	2½—3½	45—35

Load calculations consist of a combination of filler speed, maximum bottle size, and "throw" in ounces of syrup per bottle.

$$\frac{\text{(Bottles/min) (oz syrup/bottle) 60 min}}{\text{128 oz/gal}} = \text{gph of syrup}$$

$$\text{(Syrup, gph) (syrup specific gravity) (8.3 lb water/gal) (syrup specific heat) } (T_1 - T_2) = \text{Btu per hr.}$$

Where $T_1 - T_2$ = temperature difference of syrup.

While the final syrup temperature may be ideally placed at the same temperature of the carbonated water which it will contact, for practical purposes a value between 60 to 70F in the syrup filler will prove satisfactory.

This condition of syrup cooling presupposes beverage filling systems in which syrup is first placed in the bottles followed by carbonated water. In such systems the variation of associating syrup and water temperatures may approximate 35 to 45F for water and 50 to 70F for syrup with the final variables of type of drink, specific gravity of syrup, intensity of carbonation, and mechanical filling equipment peculiarities determining the exact design temperatures. Table 2 presents interesting data for the various flavors and types of carbonated beverages. Heat loads are determined as a sum of the individual water and syrup loads. Cold process syrup is usual for this application.

Syrup Room Cooling

Although infrequent in practice, air conditioning of syrup rooms provides the benefits of sterile atmosphere, and holding temperatures for syrup stored in tanks preparatory to use. In most cases a 70 to 80F room is adequate, with air washing facilities to reduce airborne impurities. Many of these rooms are cooled down to 45F and serve as a cold room. In this type of room, syrup may be stored for 15 hours to allow most of the air beat into the syrup in mixing to settle out.

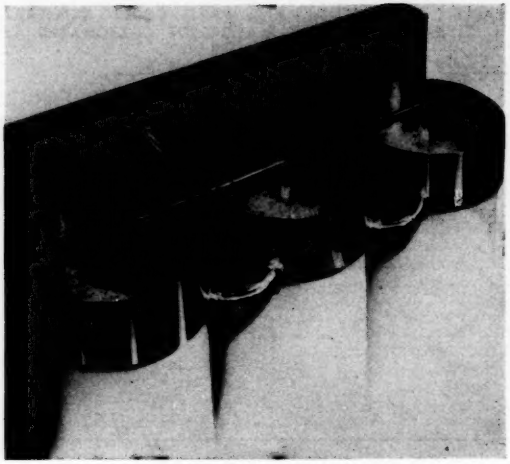

Fig. 3. Circular water distributing cups of an instantaneous water cooler and straight evaporators provide non-agitated water film flow.

Load calculations for this type room are extremely variable and beyond the intentions of this paper.

Winter Operation

Depending on the climate, each plant will present a variation in refrigeration. Winter operation may call for little or no refrigeration, but less output because of a decrease in the amount of beverage consumed.

Since there is a reduction in the amount of beverage consumed, capacity reduction features on all cooling equipment are desirable for operating economy. Contrary to summer loads, which tie in with maximum water temperatures and beverage production, winter operation calls for accurate throttling due to low water temperatures and reduced beverage production.

Refrigeration as it Affects the Beverage

Carbonated water is made by the absorption of CO_2 gas by cold water in a "carbonator" in the presence of CO_2 gas pressure. Once the water becomes saturated with CO_2, that state will remain constant for short periods of time even though the pressure on the beverage is reduced to atmospheric.

This desirable holding power is termed CO_2 retention and is dependent upon constant low water temperature, purity of water, and non-agitation. Thus during the filling process and at the time of beverage dispensing, the life and sparkle of the drink (carbonation retention) is mainly dependent upon consistently low water temperatures.

Table 1, when analyzed, shows the loss of carbonation with temperature increases. In this connection the terms "volumes of carbonation" or "gas volumes" are a multiple of a basic volume which is defined as the amount of CO_2 gas absorbed by an equal volume of water at atmospheric pressure and 60F. Refrigeration of water to 35F with varying CO_2 pressures give the volumes of gas indicated in the table.

The refrigeration of syrup provides unity of action when mixed or added to water and helps provide the final quality control over the beverage.

Refrigeration Equipment

The type of mechanical units for producing cold water or syrup are many in number but follow basic styles. The flow diagram for one type of instantaneous water cooler is shown in Fig. 2.

Evaporators are of the Baudelot, tank, and shell and tube types. Most desirable are the instantaneous coolers which, although requiring larger condensing units, require less valuable floor space than the huge reservoir storage type cooler of past years. Such evaporators should be maintained as sanitary as those required in the milk industry. Stainless steel and chrome plating are, therefore, of first importance.

Condensing units, as presently produced, can be obtained with capacity control devices to provide economical operation under varying bottling conditions. Those giving at least 50% capacity reduction are suitable.

Carbonation-coolers are a specific manufacturer's item designed to cool and carbonate a predetermined mixture of water and syrup as an instantaneous operation. The refrigerant condensing unit which operates in conjunction is separate and can be so furnished. Popular refrigerants are Freon-12 and ammonia with the former preferred because of its non-toxic properties as related to plant personnel, and the food product handled.

Where high water rates, limited sewage disposal, sewage disposal taxes, high water temperatures, rigid city codes, and low wet bulb temperatures exist, the importance of an evaporative condenser is apparent. In bottling plant operation, water in quantity is truly an important item.

Power and Water Considerations

Instantaneous cooling requires motors of 3 to 75 hp. With present-day power restrictions, coupled to the many lesser sized motors operated in the average beverage plant, reduced voltage starting has become an ever-present possibility.

As is the case with instantaneous water cooling, small water reservoirs, when not drawn from at the same rate at which they are filled, may cause a continual short cycling of the entire cooling system with objectional starting and stopping. Power company restrictions, equipment wear, and added power consumption will follow unless simple and adequate controls are provided at the time of installation. Such short cycling can be held to one cycle per hour, if the rest of the bottling line operates continuously.

The selection of compressor horsepower should take into account water rates as compared to power rates, keeping in mind the already large quantities of water used for other beverage plant purposes. Water is required for bottling, syrup making, refrigerant condensing, bottle washing and the daily plant sanitation wash down. Based on these conditions, and the intended compressor suction and condensing temperatures, motor sizing can be economically determined.

Electric Panel Heating for Homes

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Electric power provides a simple means for supplying panel or radiant heating in homes. Not only is the possibility of this type heating discussed, but data is given regarding a new system developed after extensive research.

ELECTRIC space heating over the past decade has offered the consumer very little except convenience. Today, with improved equipment and a more intelligent approach to the application of this heating medium, its use is rapidly expanding. However, future expansion of electric heating is dependent not only on design, but more important, on the heating engineer's competency to use it properly. Electric space heating equipment and design rely on accurate evaluation of the particular thermal requirements. Without a sound engineering approach, the use of this very flexible heat source will be severely limited and possibly rejected—much the same as in the 1920's.

Except for a few isolated areas, the practicability of electric heating for the home, from the consumer's point of view, is dependent on the heat loss of the structure. Omitting areas having very low electrical rates and sections of the south which have a relatively low annual heat requirement, complete electric space heating should not be attempted unless the home is well insulated and has a reasonable heat loss. Unless there are overriding circumstances, the heating engineer should pass as unsuitable any structure which does not meet some assigned index. Electrical energy, when considered on a cost per heating unit basis, is a high grade fuel, and conservation in its use should be stressed; first, by providing a minimum of heat leakage and, second, by applying it in the most efficient means.

Aside from its consideration for complete house heating, an electric heating source has many applications as a secondary heat source, and for supplemental heating. Installations using a conventional combustion system for supplying the major portion of the heat load have been supplemented with an electrical system which provided the close adjustment for temperature control. The primary system supplies the bulk of the heat requirements while the electric system, with its flexible heat source, overrides to supply a small heat requirement and maintain constant comfort conditions. With a dual heat supply, the rapid response of an electric system ably fulfills the heating needs of the in-between seasons of late spring and early fall. Because it can be placed in any location, use of an electric heat source has found many applications for spot heating —reading area, over a child's crib, and balancing cold areas. The addition of one or more rooms to an existing dwelling often presents a heating problem due to the location of the added rooms, or because the existing heating equipment cannot take the added load. With an individual room heat source which can be placed within the new spaces to be heated, a knotty problem finds an easy solution.

Electric Heating System Design

Many systems have been devised for the use of electric energy for heating. Some include unit convectors, forced air units, combination radiant-convector heaters, central warm air furnaces, units embodying storage capacity, built-in panels, prefabricated low temperature panels and possibly several others. In the past, many electric installations were made without proper engineering considerations in the selection of design or the application of the system type selected.

Each electrical heating application must be carefully engineered with due consideration for reducing heat loss to a minimum, selection of equipment type for a particular job, and competent supervision to in-

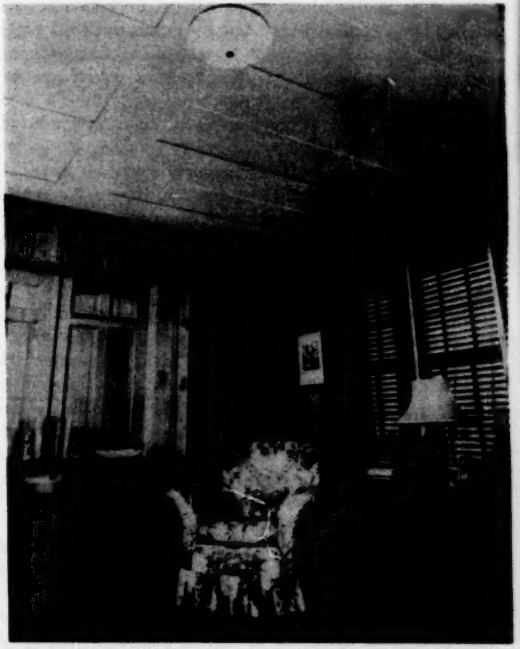


Fig. 1. Typical installation of an embossed application of electric surface panel heating.

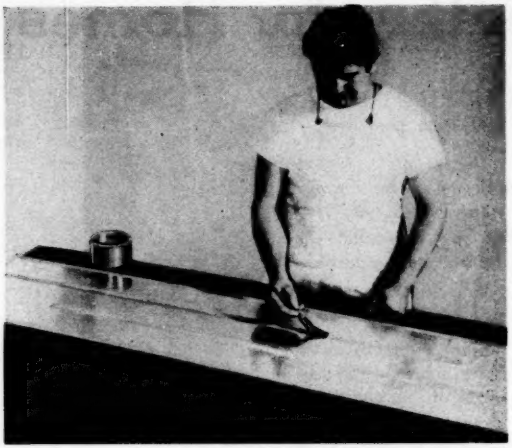


Fig. 2. Activating the holding adhesive prior to installation of panel.

sure proper installation. Controls are a very important component of any electric heating system, and they must be carefully selected to match the operational characteristics of the heating equipment.

The heating industry can no longer tolerate the apathy it has heretofore shown towards electric heating. There are too many examples of mistakes that have been made and with a premium fuel; they are costly.

Electric Panel Heating

Panel or radiant heating is a logical application of electric heating. Such a system dispenses with the high intensity irradiation which is characteristic of spot radiant reflectors or unit-type heaters which are in common use today.

Since with a panel system no attempt is made to heat the air, a comfort balance is effected at lower temperatures. By maintaining the heat loss rate of the body at a lower ambient, a panel system has a lower power requirement than a conventional electric heating system. This is particularly true with a ceiling panel installation which takes advantage of a larger radiation component.

With the growing public interest for radiant heating, electric energy has also been applied in many on-the-job constructed radiant systems. A number of installations are in use today in which soil heating cable or other low temperature cable has been embedded in the floor slab, or in plastered ceilings and walls. Several systems also are in operation which circulate hot water through a pipe coil in either the floor or ceiling, and the water is heated electrically.

With any of these systems the quantity of heat which goes into storage in a heated slab is high. The heat absorbed by the heavy masonry causes temperature lags so that there is slow response to weather changes. In some areas where electric slab heating is used, excessive variation of inside temperatures and also objectionable operating costs have been reported.

With a flexible heat source such an electric energy, there appears to be little justification for converting the energy to heat at any point except in the space to be heated. By following this approach, the losses which would occur at some remote conversion point, plus all the transmission losses, are avoided. All the energy is converted in the space where the heat is desired.

Electric Panel Heating Design

By utilizing surface electric panel heating equipment, the difficulty of high thermal mass can be eliminated, for there is no necessity for plaster or any other building materials to form the heat exchanger. The heating element can function as the emitting surface. Flexibility of control, unobtainable with other house heating equipment, is a distinct advantage of such a surface system, while providing maximum body comfort. It enables more operational savings by allowing control monitoring, zone controlling, and elimination of overshoots.

General Electric has spent several years in the investigation and development of a low temperature radiant panel heating system. The objective was to develop a heating system which would have all the desirable features of panel heating and at the same time have a more practical means for doing the job electrically. This necessitated a system with a completely prefabricated unit as the heat source, with the design characteristics predetermined. Such equipment had to be applicable to both new and existing structures and require no more than redecorating of the room in which the units are installed. An installation is shown in Fig. 1.

The unit developed is a very thin wafer-like panel structure approximately 30 mils thick. It is a high pressure aluminum phenolic laminate having a copper alloy heating element. Both sides of the phenolic core are covered with a specially developed aluminum sheathing which provides a ground for the entire system, gives a good cross heat conduction, and provides structural strength for the panel. Each unit has an assembled raceway section which houses a termination block for power supply to the panel. The raceway base is in electrical contact to both sides of the panel, and the ground circuit is completed through this section.

Panels presently manufactured have a wattage density of 21 watts per square foot, or a heat output of

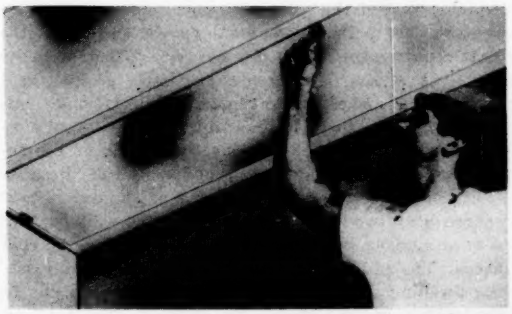


Fig. 3. After panel is positioned on the ceiling, it is rolled to insure bonding contact.

72 Btu. To accommodate room modular of present-day residential structures, the panels are made in three sizes: 17½ x 46 inches; 17½ x 58 inches; and 17½ x 70 inches. All units are designed to operate from a 230-volt power supply. The back side of the panel has an adhesive pattern in tape form for attachment to ceiling. When the panel is to be mounted, the adhesive pattern is wetted with a prescribed activator solution, as in Fig. 2, and the panel pressed into position.

The logical location for an electric panel system is the ceiling, for not only will this position result in a higher radiant heating efficiency, but the ceiling provides the largest uninterrupted surface for mounting the panels. With a ceiling installation, the location of furniture and drapes is of no concern since they cannot blanket the panels, and susceptibility of accidental damage to panels is reduced. Wall panels may be used to balance heat losses through large picture window, or other cold spots. Another application for wall panels is the small bathroom where it may be desirable to provide a foot-to-head warming effect when stepping from a bath.

Application of Electric Panel Heating

Operating cost is a very important factor to consider in the application of electric heat, and this cost for any heating system is directly related to heat loss during some specific period of time. Thermal insulation is, of course, necessary on the back side of the surface to which the panels are mounted to minimize any reverse losses. Insulation of other possible heat loss areas must also be considered. An adequate insulating job results in lower heat loss and also provides optimum comfort environment with a panel heating system. A panel installation has as its objective the control of the MRT of the room, and insulation assists the heating panel in achieving this effect.

In applying electric panel heating, a careful analysis of the heat loss for each room must be prepared as the basis for specifying the required capacity. It is important that adequate capacity be provided. A rule-of-thumb estimate, which often results in excess capacity, cannot be tolerated. With a flexible heat source, there is no longer a need for excess capacity.

Two general ceiling installations are used: (1) an exposed or embossed arrangement in which the panels are treated functionally; and (2) a flush installation in which the panels are completely concealed. With either arrangement, it is desirable to arrange the panels to give a uniform distribution of the heating surface. The panel design affords complete flexibility in panel positioning, and many functional arrangements are possible. One design is shown in Fig. 1. Slight deviations from a uniform distribution of the heating surface will not affect the performance of the heating system.

With a surface panel heating system, each room is a separate and distinct heating unit. In very large rooms it is sometimes an advantage to split the heating capacity into two sections; however, for the most part, each room is a separate zone. A separate branch circuit is provided for each room, and the panels in each room are connected in parallel by placing a stranded conductor into the channels of the connector block which is assembled to each panel.

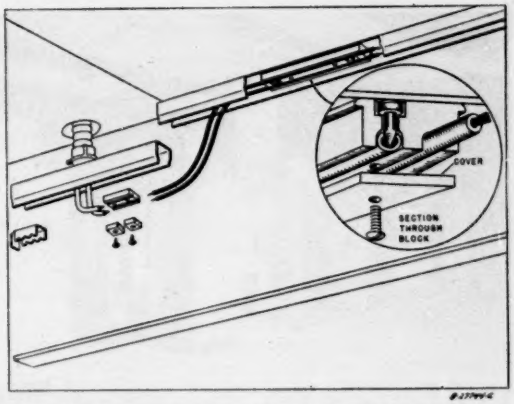


Fig. 4. Power connection for surface panel heating.

With an extremely low mass unit such as a surface panel, a control means is necessary which will take advantage of the equipment flexibility. Therefore, the panels in each room are placed under the control of a separate low voltage thermostat which has an operating temperature differential of ½F or less.

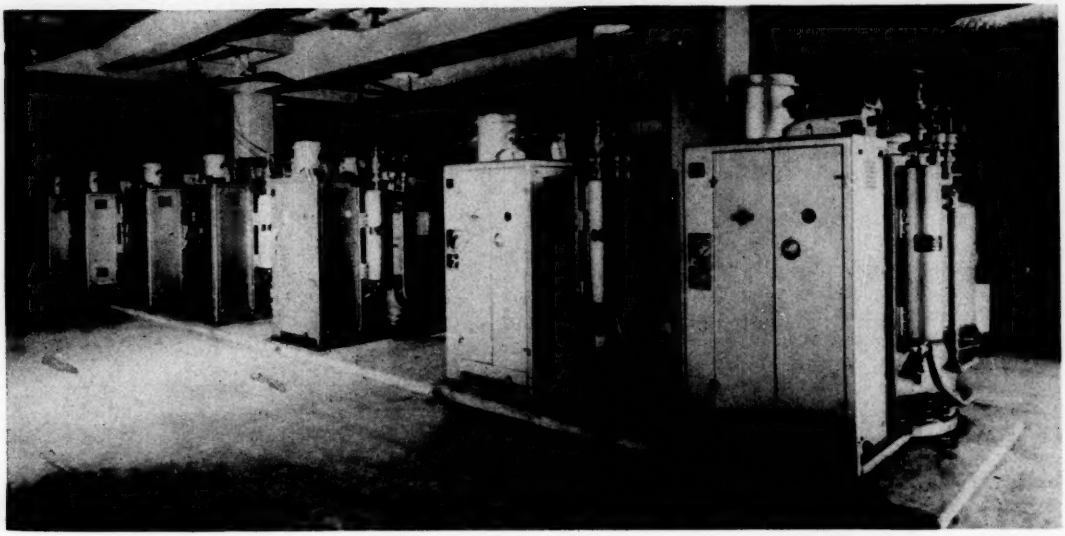
Installation

Once the heat distribution and capacity have been determined, the panel system is ready to be applied. A layout made by snapping a chalked line is helpful in maintaining a predetermined panel pattern. The adhesive coating on the back side of the panel is activated by brushing with a suitable solvent. After the holding adhesive is activated, the panel is pressed into position on the ceiling surface and rolled into contact, as in Fig. 3. About two minutes is required to install one unit. Panels in any one group are connected in parallel by placing a No. 12 Type T stranded conductor in the channels of the connector block which is assembled to each panel. As the wire is placed in the channels, wire insulation is pierced by panel contactors, and the power connection is automatically effected. The connector block cover is secured with two screws, as in Fig. 4.

After the panels are installed, the entire surface can be finished by painting to blend with the interior color scheme. It is interesting to note that the panel system must be painted or finished by some acceptable means before operation in order to obtain the proper emitting surface conditions.

Conclusion

Studies made over the past five years clearly indicate that electric house heating has definite application in the residential heating field. Its advantages are being enjoyed by many, but its expansion must be on a sound engineering basis. An electric panel heating system has many advantages for the user, the most important of which possibly is the complete uniformity of comfort conditions.



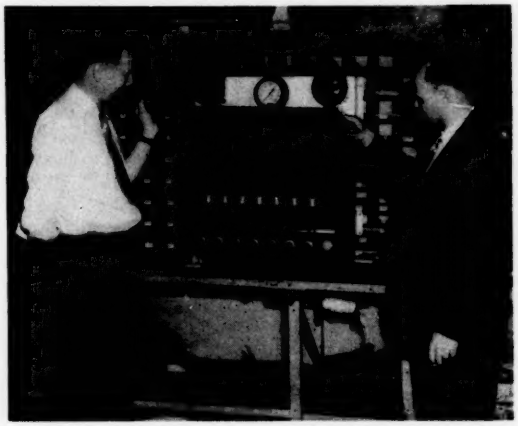
Multiple Steam Generators Serve Laundry

A railroad-owned laundry is being served with a total of 31,500 lbs of steam per hour by a parallel arrangement of steam generators of a type heretofore used to supply heating and air conditioning needs of diesel-powered trains.

AT the new Union Pacific Railroad laundry in Ogden, Utah, 13,000 pieces of laundry, totalling 3,330 lb, can be washed, dried, ironed, folded, counted, and tied in bundles within an hour and a half. Secret of speed in the bulk handling of laundry is in a row of seven fast-heating steam generators. The generators were designed originally for heating and air conditioning on diesel-powered trains and each can develop 250 lb of steam pressure in two minutes from cold water. The capacity of each generator is over 4,500 lb of steam an hour. Thus, a total of over 31,500 lb per hour can be produced by the row of seven generators used in the laundry. Pressure at the Ogden plant will be kept at 100 lb per square inch.

The new plant will handle linen of all Union Pacific passenger trains and hotels and restaurants operated by the system. Installed will be eight washers, three extractors, four flatwork ironers, three driers, twelve tumblers, 42 pressing units, six folders, one stacker, three tying machines, two continuous belt conveyors, and a monorail system for moving baskets of laundry.

The seven Vapor-Clarkson steam generators will be used not only to heat washing water to 180F for laundry, but will also heat the building in the winter. Steam developed by the generators will be used in operation of washers, ironers, and pressers. In the basement of the building will be two large heat exchanger tanks, each of 2,000-gal capacity. Steam from the generators will be conveyed to the coils with-



Master control selects any or all of seven Vapor-Clarkson steam generators on the basis of load requirements.

in these tanks through a 2-inch line bled from a 16-inch header loop. The 16-inch steam header is a closed loop of pipe over the entire row of steam generators and can be kept up to pressure by any one or all of the generators under varying load. In addition to the 2-inch line maintaining heat in the wash-water tanks, a supply line is taken off the header to serve laundry equipment and to furnish building heat.

Condensate from the heat exchanger tank coils is collected in a 1,000-gal tank to which a make-up water line from water treatment equipment is also connected. Blending of make-up and condensate is supplied as 140F feed-water to the generators.

Controls

The generators are each fired with a hot atomized diesel fuel oil and are completely automatic in operation from 1/3 to full capacity. A steam pressure switch turns on the fire in one or more units when steam pressure in the line is below a set minimum and shuts burners off when the line is up to pressure. A central control panel is arranged so that burners are turned on and off one at a time in accordance with demand on the system. Each steam generator is controlled by a separate fractional horsepower motor-driven switch assembly. Wires to steam generators from the control panel are combined in separate cord and plug sets for each unit so that the sequence in which units are called upon can be varied to equalize wear. Each machine has an electric eye to turn the unit off if the fire does not light properly. If for some reason the unit should fail to work when called upon, the master control will cause an alarm to be given and pass on to the next steam generator. There is a manual switch on each generator for individual control.

Fueling

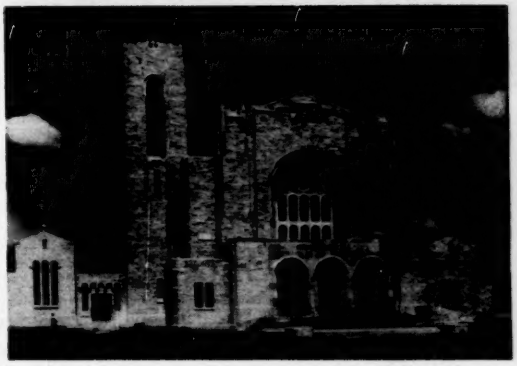
Diesel fuel oil is stored in a 30,000-gal buried tank from which a 2-inch oil supply line feeds a 2,000-gal day tank, which is in turn connected to burner supply and return lines. The 2,000-gal tank is enclosed in a concrete vault separate from the main floor of the laundry. Oil is piped through a 3-inch supply line to fuel oil pumps on each burner. Returns from the burners are connected to a 2-inch oil return, and surplus oil is fed back to the day tank.

A 7½-hp electric motor on each generator runs the fuel pump, water pump, and forced draft blower.

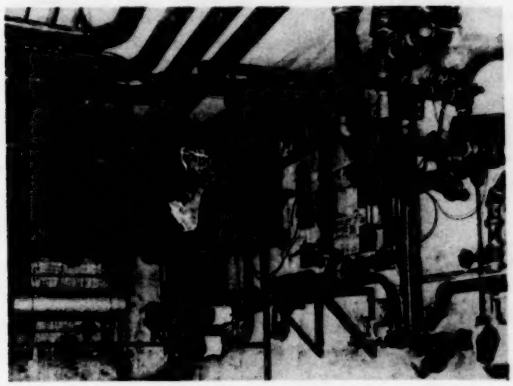
Radiant Heated Church

The "Children's Cathedral" is another addition to the famed city of Mooseheart, Ill., founded and operated by the Loyal Order of Moose and maintained by it for the care and education of deceased members' children. Funds for this first all children's church were raised by popular subscription from among the nearly one million members. Built primarily for the use of resident children, it is the first civilian church erected to serve all faiths under one roof.

It is one of the largest churches in the country to use radiant heating. Nearly seven miles of 1½-inch wrought iron piping (over 46 tons) was laid in the church floor to provide circulating hot-water heated panels. Steps leading to the three altars are also heated with embedded pipe. Structural floor slab is made of insulating concrete to prevent excessive heat loss to the basement and ground, and out the slab edges to the atmosphere. Footings and transverse stringers, made of pipe, supported the heating grids and coils until the floor was poured.



Childen's Cathedral at Mooseheart, Ill.



Steam converters, pumps, and controls in cellar.

The building contains five separate heating zones, each with an outside master control (combination thermometer and barometer) as well as an inside thermostat. The outside master anticipates climatic changes and adjusts its system so there is no lag in the inside temperature.

Heat for the church comes from the central plant in the form of exhaust steam from the electrical generating units. It is carried through a tunnel to the converters located in the church basement. Here, modulating valves at the converters regulate the amount of hot water introduced into each system to control heating effect of the various panels.

Measures to avoid troubles in

Domestic Hot Water Systems

T. W. REYNOLDS

Difficulties in the operation of domestic hot water systems can generally be traced to faulty design. By means of simple diagrams of piping layouts, attention is directed to the cause of faulty conditions and steps that should be taken to correct such design.

Part 2

Protecting Circulator from Dirt

Many interesting points are brought out in Fig. 8. Here we have the familiar dip or trap, but for a different reason than given in Part 1.

The trap in the case illustrated is at the circulators for directing sediment into the dirt pocket. There the dirt is confined well down and away from the circulators, thereby reducing circulator service calls. The bulb for the aquastat at the right-hand circulator is inserted in a ¾ inch tapping through a reducing tee 1½ inch or larger, since at least 50% of the bulb should project into active water. The same is required for any thermometer. There should be no nipples or bushings to deaden circulation at such points.

The aquastat at the tank is tapped ¾ inch into the tank and is located at the center of the tank horizontally and vertically. The aquastat standard temperature range can therefore be raised or lowered to meet job conditions. Flow to the tank is angular upward for reasons previously stated, while the tank return starts with a running thread projecting up in the tank 3 inches from the bottom and above any sediment. The house return circulation to the right-hand circulator is usually made two pipe sizes smaller than the hot water supply main. Both circulators have bronze bodies, as they are pumping domestic water.

Installation for Under-Capacity Boiler

In Fig. 9 we have an arrangement suited to a boiler which is under-capacity, or for any proposed installation where it is desired to save in first cost by reducing size of equipment. For example, boilers in commercial laundries are usually undersize due to later load increases, or to deliberate reduction to a 10 hp boiler at time of installation. Such close figuring gets around the usual municipal requirement for a licensed engineer to operate boilers above 10 lb pressure when over 10 hp in size as actually applied. New York City considers a horsepower as 10 sq ft of boiler heating surface. To avoid these requirements, boilers are often built with 99 sq ft of heating surface (9.9 hp). Another of its regulations is that safety valves on low pressure boilers shall be set to relieve at not over 10 lb pressure. Based on prior applications as precedence, and to agree with manufacturer's safety valve setting and usual boiler guarantees, the setting of safety valves are often allowed at 15 lb and will be so found, despite printed regulations.

Any deliberate reduction to a 10 hp boiler at time of installation, as cited, achieves one thing at the expense of another, for with undersize boilers the hot water demand is so great at times that the boiler cannot steam with the full load and the water line close to the steaming surface.

With an intermittent load due to in-between operation of laundry machines, the job can often be done with a boiler 50% undersized, providing the factor of time for heating cold water make-up passed to the tank is lengthened by reducing requirements in gallons per minute to gallons per hour. Such operation can be achieved by suitable proportioning or distribution of cold water make-up through operation of valves *A* and *B*. For example, if we assume that the

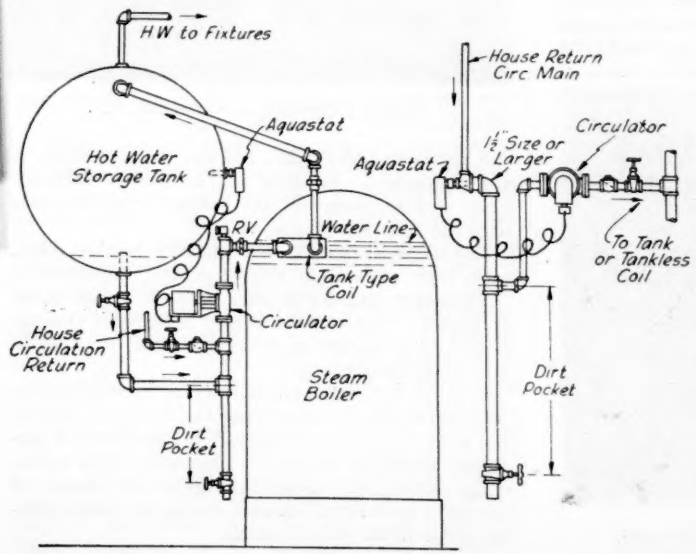


Fig. 8. Proper dirt pockets protect circulators.

boiler can handle but 60% of peak demand hot water supply, then valve *A* would be throttled down to 60% and the boiler will maintain its pressure at maximum capacity. Valve *B* would at the same time be opened enough to pass the (40%) balance or cold water make-up to the storage tank to complete the 100% of volume at the final temperature desired at the machines. When the hot water demand is satisfied, the pump circulates through the tankless coil to bring cold water in the tank up to required temperature in readiness for the next demand period.

The check valve near the circulator is designed for least resistance to gravity circulation. Its setting at an angle of 45 deg helps in this respect, and it is easier for the valve flap to close. In such position the valve is also self draining. The return circulation pipe is fitted with a running thread of 4 inches within the tank to keep sediment on the tank's bottom, away from the circulator.

Coil Offset to Below Water Line

It is necessary, of course, that the coil in a steam boiler should be submerged below the boiler water line and yet keep the coil above the boiler tubes. An offset coil of this type, Fig. 10, permits this to be done.

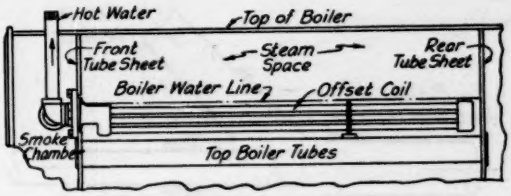


Fig. 10. Coil offset to below water line.

Inadequate Heat with Small Boiler

In Fig. 11, the large gate valve shown at the tankless heater is upside down, to prevent air binding and for convenience in operation. While its installation is optional and its omission saves the contractor money, without one the owner pays more for the labor of servicing should the heater have to be removed for any reason. In the case of the backwash valve at the boiler, there is, however, no choice. This is a "must" valve. Its closing allows the heater to be cleansed by water pressure flushing out through the draw-off valve. The possibility of reverse circulation is again present unless prevented by the usual dip or trap. In this case it is simply formed by extending the heater return full size and down first to the floor (where, incidentally, it forms a heater support) and then rising to boiler return inlet.

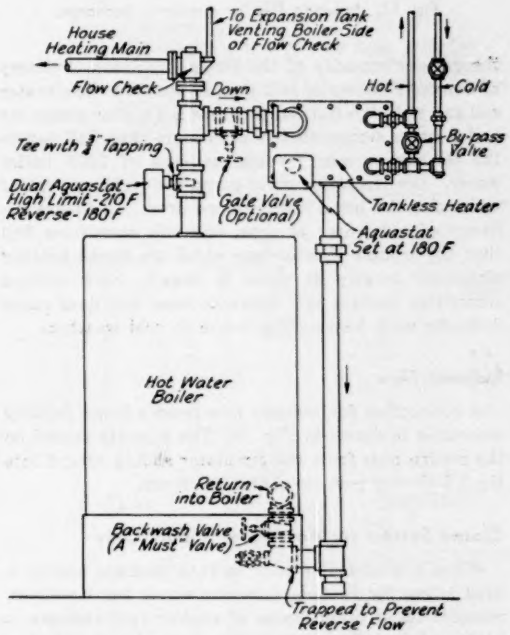


Fig. 11. Control for small boiler with small water content.

Fig. 11 also illustrates how a small installation of this kind should be best controlled. The aquastat for house heating is of the dual type with high limit at 210F and low limit reverse-acting at 180F. The summer-winter low limit aquastat in the heater shell for hot water supply is then set at 180F. Boiler water is maintained at 180F (per standard practice) to insure hot water of 140F temperature to the fixtures and the heater coil is sized (as usual) for cold water entering at 40F and leaving at 140F.

The house thermostat and house circulator come on together and in a small boiler of only 20 to 30 gallons of water content, its limited storage of 180F hot water is soon lowered in temperature to less than 160F by

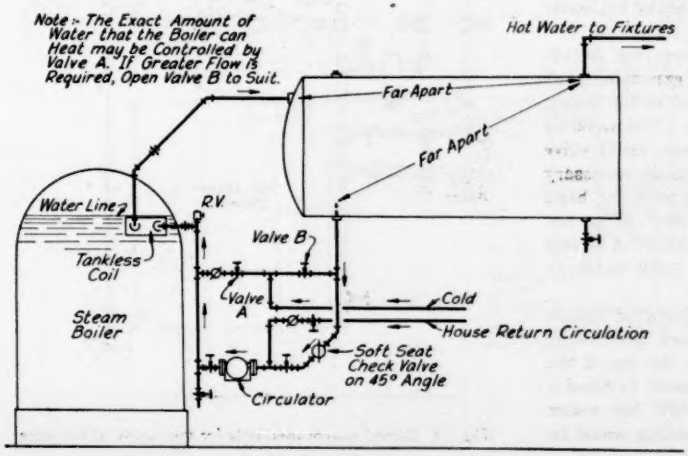

Note:- The Exact Amount of Water that the Boiler can Heat may be Controlled by Valve A. If Greater Flow is Required, Open Valve B to Suit.
Hot Water to Fixtures
Far Apart
Far Apart
Water Line
R.V.
Valve B
Tankless Coil
Valve A
Cold
Steam Boiler
House Return Circulation
Soft Seat Check Valve on 45° Angle
Circulator

Fig. 9. Arrangement for under-capacity boilers.

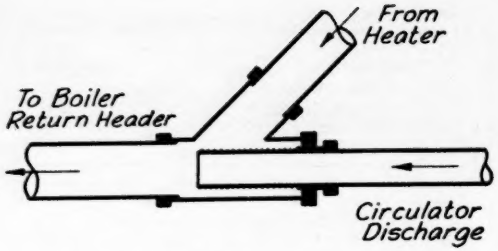


Fig. 12. Inducing flow by circulator discharge.

the greater capacity of the house circulator. Delivery of domestic hot water will then be too cold. The heater coil can not give full temperature hot water where the boiler water temperature lowers more than 20F before the oil burner acts for maintenance of 180F boiler water. The circulator must pump the right amount of water for the usual temperature drop. To insure delivery of hot water at taps, one will sometimes find that the trouble shooter has wired the house heating circulator to stop as water is drawn. Such method sometimes insures hot water at taps, but does cause difficulty with heating the house in cold weather.

Induced Flow

A connection for induced flow from a house heating circulator is shown in Fig. 12. The running thread on the return pipe from the circulator should extend into the TY fitting past its center as shown.

Closed System for Hot Water Supply Only

When a steel boiler with built-in tankless heater is used solely for heating domestic water for laundries, restaurants or other places of similar requirements, a preferred installation is a hot water heating boiler, Fig. 13, with a closed expansion tank. The boiler should be under aquastat control with its water temperature up to 250F (equivalent to 15 lb steam gage pressure) to obtain large volumes of domestic hot water of 180F or higher temperature. This makes an efficient system with no possibility of steam valves popping, as with a steam boiler when a heavy hot water demand suddenly ceases.

The usual hot water boiler trim is required, including a boiler relief valve set at 30 lb, expansion tank sized for one-tenth of the water volume in the boiler, and a hand-valved cold feed water line. The tankless coil should be protected by a 125 lb water relief valve installed in its cold water inlet. This is necessary should the boiler happen to be operated with the hand valves closed. A water service line at 180F can be run direct to the dishwashers and like equipment. A second line with mixing valve can be run, for 140F water, to basins, sinks, and similar fixtures.

While the by-pass valve should be installed upside down for convenience in operation, such position is mainly required for venting any air at the top of the pipe when the valve is only slightly opened, to bleed a small quantity of full temperature 180F hot water into the 140F hot water main. This bleeding would be done when it is found that the house return circulation is not fast enough to keep the hot water in the mains up to the desired temperature. Should the tempering valve fail, the by-pass valve can be fully opened. Tempering valves with self-contained thermostatic elements should always be installed below the coil. This lengthens the life of the valve elements and gives a better mixing action.

Pre-heated Tank Storage Cuts Boiler Size

The piping arrangement in Fig. 14 is an alternate to that shown in Fig. 9 where a boiler and storage tank smaller than usual can be used for heating large volumes of full temperature domestic water, and where the gpm hot water demand is large but of short duration. Such demand occurs in commercial laundries with longer in-between-time periods when machines are not operating or drawing hot water.

The arrangement, Fig. 14, enables water in the storage tank to be reheated in preparation for the next demand. It is called a tank-tankless system, because a multi-tube tankless heater heats all of the water and a tank is used to store and maintain the water preheated at from 120 to 140F. Once the draw and off periods of the machines are estimated and charted; the minimum size of tank and boiler can be determined.

In operation, the circulator pumps tank water through the tankless coil to maintain tank water temperature preheated at 120 to 140F, as desired. When hot water is drawn, cold water enters the tank and forces the preheated water out of the tank and through the coil where it is raised 40 to 60F to a final 180F and passed on to the machines. Such a small temperature rise during a heavy water demand gives a minimum load on the heating boiler at the peaks. Then, as the draw of the machines is satisfied, the cir-

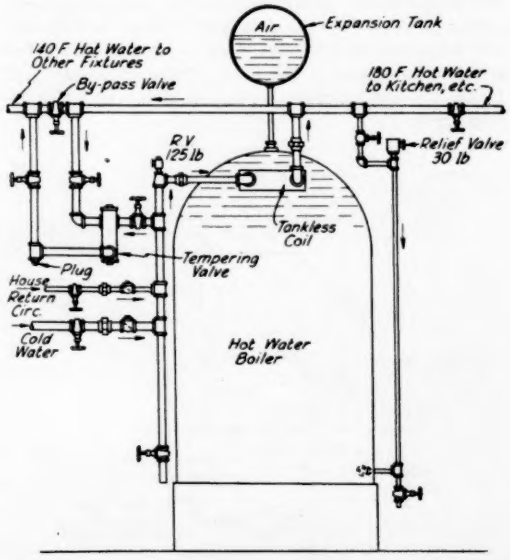


Fig. 13. Closed system used only for the supply of hot water.

culator operates to bring the tank water temperature back up to the preheat temperature of 120 to 140F.

Carrying but 120 to 140F tank water temperature increases the life of the tank and saves fuel by reducing radiation losses from its shell. The higher water temperature of 180F only occurs for short intervals when water is being drawn and then only in the coil. Laundries practically burn up many tanks in which 180F water is maintained.

The soft seat check valve in the 45 deg angle pipe closes when water is drawn, thus preventing short circuiting of cold water to the hot water main. All cold water then goes to the tank. This check valve opens by gravity with minimum friction to the water flow through the circulator during the time it pumps tank water to and through the tankless coil for make-up of tank water temperature. The check valve just before the tempering valve prevents backward flow. When pressures are equal on each side, it cannot open. Pressures fluctuate momentarily as water is drawn or the circulator runs. Therefore, to prevent chattering, the check valve can, if desired, be fitted with a neoprene rubber disc on the flapper.

Correction for Velocity in Vertical Boilers

A vertical steel boiler of the type shown in Fig. 15 naturally sends water upward at very high velocity whenever the boiler steams. The velocity may be so strong as to by-pass the low heater flow inlet, and, in this way, actually stop all downward circulation through the heater. In fact, it may even reverse the flow through the heater. Such a difficulty was eliminated in one case by raising the heater with its inlet pipe to just 2½ inches on center below boiler water line. Then the hot boiler water freely entered the heater, since its velocity had been expended and it had no other place to go.

Air Chamber Construction — Good and Bad

Proper air chamber construction to prevent water hammer is shown in Fig. 16. Minimum height of air chamber should be 5 ft. The higher the water pressure, the greater the compression of air, and therefore the higher the air chamber column should be. The old-fashioned air chamber is shown at the right hand of the sketch. It will waterlog, for, regardless of air volume of large diameter pipe, air can escape through the bottom pipe connection much easier than where greater height is obtained to maintain a water seal. Suction is set up as water pressures are released by large and sudden withdrawals of water, and this creates a lift that must be counteracted by a deep water seal leg. This leg should have sufficient height for air expan-

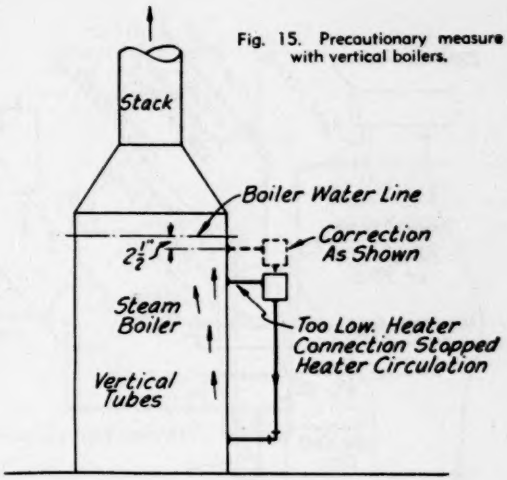


Fig. 15. Precautionary measure with vertical boilers.

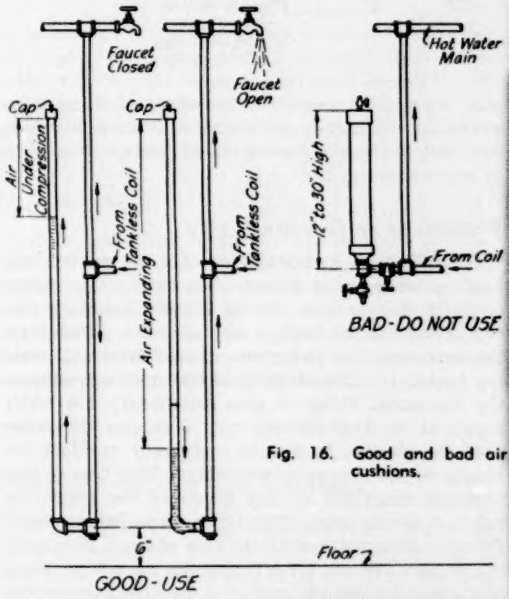


Fig. 16. Good and bad air cushions.

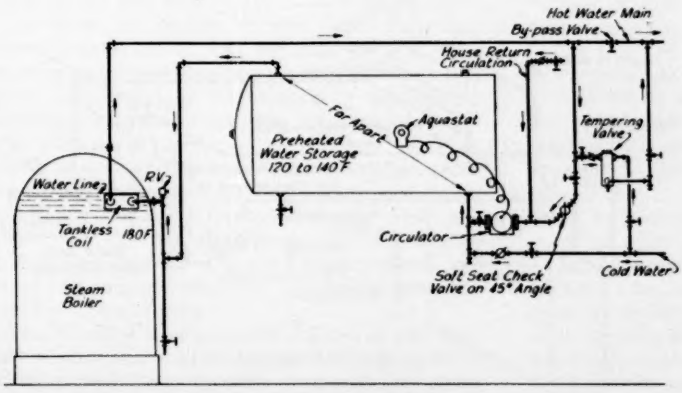


Fig. 14. Boiler size saved by pre-heated tank storage.

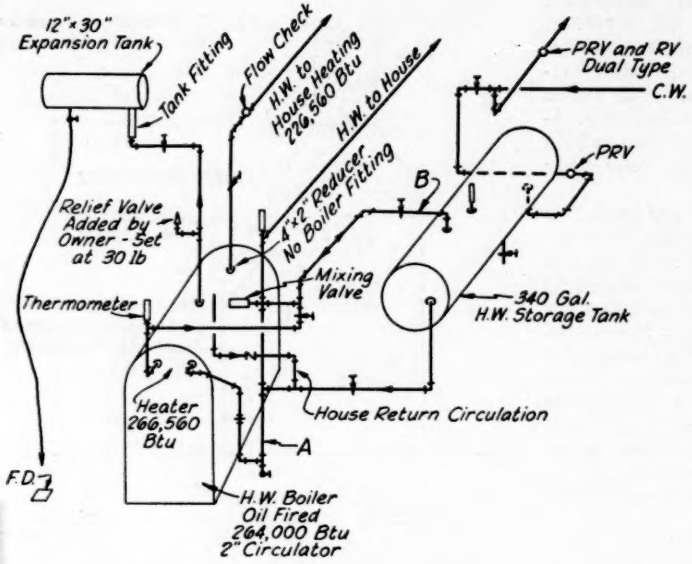


Fig. 17. Installation of an oversized system.

sion to maintain water seal at bottom of chamber, as shown in the higher air chambers. Such chambers have been in active service for 15 years without loss or replacement of air.

Problems of an Oversize System

Fig. 17 shows an installation of a hot water house heating boiler and a domestic hot water supply boiler coil with storage tank. At the owner's insistence, this equipment was all made a way oversize, particularly the tank, since the owner was in the business of making tanks. In spite of all these elaborate precautions, the equipment failed to give satisfactory hot water supply at the final delivery end. Whenever the owner used the shower, he had to continually readjust the handle on the shower mixing valve. This trouble was probably magnified by the action of the tempering valve, a device quite often temperamental in itself. Pressure drop varies with the rate of draw, thus making it more difficult for a tempering valve to properly mix water for maintenance of a uniform temperature at its outlet.

Referring to Fig. 17, the dip at *A* is for the usual purpose of preventing reverse circulation. Piping is also arranged to withdraw hot water from either tank or coil. Hot water, however, cannot be stored in the tank as it is heated by the coil, except after a long standby period of no draw, because the resistance of the coil to gravity circulation is too great where there is no circulator. This means that water (first hot but eventually cold) will be withdrawn from the tank in preference to the coil, especially so as pipe *B* is of large size. However, this pipe could in effect be made small by throttling down its valve. No doubt the pipe was made large to impress the owner. The pipe could be removed or the valve kept closed and results would then be much better.

During the summer this installation developed another trouble. Due to oversize of boiler and oil burner, the boiler water was so rapidly heated that it flowed backward through the circulator, which was installed later in a vertical return riser at the boiler rear; that is, the water circulated up and down within this return riser and heated the nearest radiators. The system, as a whole, could not circulate backward, because of the flow check valve on the supply main. Even if this check valve had been open the slightest crack, due to some dirt or other cause, the water would not circulate backward from the supply main to the return main, but instead the flow would have been up and out through this supply main.

It was simply a case of internal circulation up and down within a 2-inch return riser. Such circulation will sometimes happen even in a 1-inch pipe. The solution of the difficulty in the case would be (1) a dip in the return riser downward before it rose, or (2) the installation of a flow check in the return to retard such reverse circulation.

Tank and Coil in Series

Actually the tank itself, shown in Fig. 17, was not needed. However, the owner desired to retain all the equipment. For an arrangement of water flow in series, in other words, for hot water stored in the tank

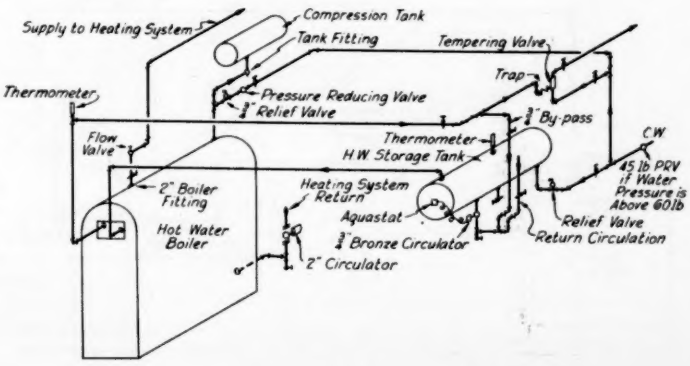


Fig. 18. Connecting tank and coil in series.

to flow to the boiler coil and to obtain final temperature in this coil, a circulator should be installed, Fig. 18, to overcome the coil resistance of Fig. 17. Due to the positive action of the circulator, hottest water can be taken from the top of the tank and circulated to the coil. Reverse circulation and withdrawal of water to the house direct from the tank are then most unlikely because of the ¾-inch by-pass at the tank. With this plan, hot water cannot short circuit but must flow in series, whether or not the circulator is running.

It will be noticed that the pipe at the tempering valve is formed as a trap. Such valves work better this way and seem to do less hunting. This arrangement is standard procedure. Also note that the relief valve is installed, as it should be, between the expansion tank and the cold water supply valve.

Short Circuit in Boiler

At one time we had boilers for steam and others for hot water, then later they were merged for use either with steam or water. The steam boiler came first. Since a boiler used for making steam develops most activity near the front section, where most of the heating surface lies, it is desirable to have the steam outlet at the rear where the lower rate of boiling will be less likely to lift water through the steam outlet.

What happens when this ancient practice is continued in a hot water boiler is shown in Fig. 19. This sketch illustrates how the flow of water in the boiler can be short circuited from inlet to outlet without properly diffusing throughout the boiler unless an internal return pipe is placed inside of the boiler water leg. Without such a pipe the pump pressure forces th water through the line of least resistance directly from inlet to outlet as shown by dotted arrows. This causes the more or less stagnated hot water at the upper part of the boiler front to steam. A domestic

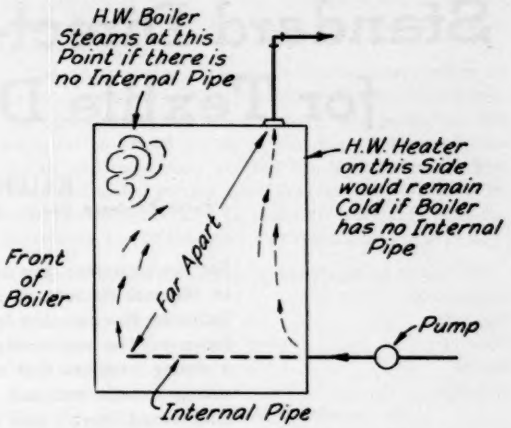

H.W. Boiler Steams at this Point if there is no Internal Pipe
H.W. Heater on this Side would remain Cold if Boiler has no Internal Pipe
Front of Boiler
Far Apart
Pump
Internal Pipe

Fig. 19. Boiler arrangement that causes a short circuit, and plan for correcting trouble.

hot water heater located at this point would then be well heated, but a heater at the opposite side of the boiler would be cold unless the boiler is provided with the internal pipe to create a flow as shown in full arrows. The boiler is much more efficient when the flow is diffused over all of its heating surfaces.

Acknowledgment

The author acknowledges his indebtedness to Lawton R. Moray for most of the sketches. Mr. Moray, through his specialization with water heaters for the past 18 years, has found the cure for many water heating troubles. Prior to such specialization, he was of Daniel, Moray & Wallen, consulting engineers, and is now vice president of Lindy Heaters, Inc.

Air Conditioning Installed for 41-Story Building

The 525 William Penn Place Corporation Building, 41 stories high, erected in Pittsburgh, Pa., has two air conditioning systems—an outer ring and an inner bulwark. One system takes care of weather variations caused by sun and wind on the exterior perimeter of the building. It consists of some 3,000 individual Carrier Weathermaster units, one under every window. The second system compensates for heat gains or losses in the central area of the building by conditioning tremendous volumes of air that are moved through metal ducts.

Contractor for installation of the multi-million dollar heating, ventilating and air conditioning systems in the building was Dravo Corp., Pittsburgh. Dravo engineers state this is the largest air conditioned office building ever constructed in the Pittsburgh area, and one of the largest completely air conditioned office buildings in the country.

Some 16 miles of copper pipe and tubing and 13½ miles of steel pipe ranging in diameter from ¼ to 24 inches are needed to carry steam, condensate, hot water, chilled water, drainage and compressed air in the two systems. About 50 million pounds of steam will be used annually. Total capacity of all the fans that move air in the building amounts to 528,000 cfm. The relative humidity will vary from 35% for winter operation to 50% during the summer.

The heart of the cooling system is in the third basement where four Carrier centrifugal compressors —three 800 hp and one 300 hp—provide refrigeration for chilling 105,000 gallons of water daily. These machines are designed to lower water temperature from 50 to 40F through a refrigeration cycle in which Freon-11 (Trichloromonofluoromethane) is used as the refrigerant.

Air moving and conditioning equipment in the second basement serves the first eight floors of the building. The 15th floor houses similar equipment for floors 9 through 23. The 32nd floor contains equipment for floors 24 through 39. The 40th and 41st floors are taken care of by a separate heating, ventilating and air conditioning system.

Standard Direct-Fired Units Used for Textile Drying Process

RALPH MIZENER
Sales Engineer, Parent & Kirkbride, Philadelphia, Pa.

For the consumer, the use of a mastic rubber coating in the manufacture of rugs has certain advantages, including the non-skid feature. For the manufacturer, however, the application of mastic coating presents a drying problem that must be licked if high processing speeds and low production costs are to be maintained. Here's how one rug manufacturer solved the problem with direct-fired industrial heaters.

A DRYING method recently installed for Prudential Industries, Philadelphia, rug manufacturers, may be applicable to many other textile drying problems. The basic equipment unit used in the drying process is a standard factory model direct-fired heater modified with duct work and controls for high temperature output.

The following description of the installation is offered by B. F. Purdy, vice president and general manager of the Philadelphia plant.

Each 12 square yards of material processed required six to seven pounds of mastic coating material, dry weight. As applied, the mastic solution was 55% solid, 45% water. The rate of evaporation contemplated was 29,540 grains of moisture per minute, or 4.22 lb of water.

The initial problem was to maintain drying temperature of 200F in a dryer room through which the rugs and carpeting were automatically conveyed. The dryer heat loss was 241,000 Btu per hr. Heat of evaporation (4.22 x 60 x 1000) was 254,000 Btu per hr. Specific heat of moisture was 38,000 Btu per hr. Specific heat of material requires 180,000 Btu per hr and specific heat of replacement air (250 cfm) required 50,000 Btu per hr or a total of 763,000 Btu per hr required to maintain a temperature of 200F in the 32 x 14 x 10 ft dryer through which the product moved at 7 to 8 ft per minute.

Load Computation Based on 220F and 10 ft per min.

	Btu per hr
Dryer heat loss	241,000
Evaporation (4.22 x 60 x 1000)	254,000
Heat content of water	38,000
Heat content of material	180,000
250 cfm exhausted air (replaced)	50,000
Total	763,000

To build up the required temperature, two standard Prat-Daniel Corp. Thermbloc units of 550,000 Btu per hr output, each, were used in conjunction with recirculating ducts and draft dampers (see Fig. 1). The heaters were placed in cinder block heater rooms outside the main building (Fig. 2) to meet local fire

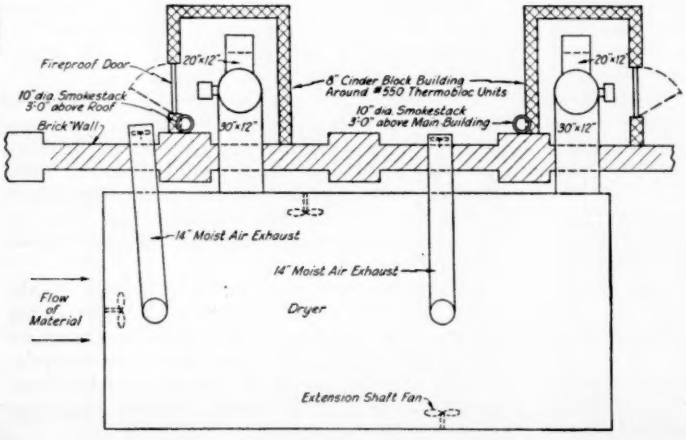


Fig. 1. Plan of rug drying system showing two heaters in cinder block annex structures serving drier room. Warm air supply ducts, 30 by 12 inches, from heater outlets enter top of drier room while smaller ducts, 20 by 12 inches, return recirculated air from floor level and pick up make-up air from outside Exhaust ducts remove moist air from vicinity of product line. Extension shaft fans maintain circulation in drier.

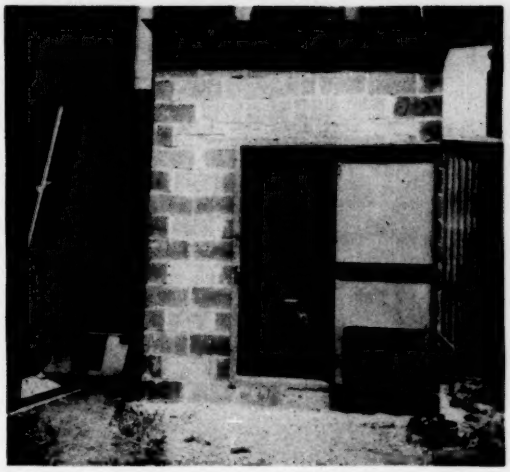


Fig. 2. Housing for heater, showing supply and return ducts.

regulations. Heated air is fed to the dryer, and return air carried back to the heater room, through insulated ducts. The heaters' fans are run continuously.

At the bottoms of the two heaters, where the intake is normally located, sections were closed off to limit the intake of air to the return duct from the dryer and the recirculating duct which admits make-up air as required. A special control in the top discharge duct starts the oil burner when the output temperature drops below the setting. The damper in the recirculating duct is pre-set to admit a small amount of make-up air. The oil burners are operated intermittently to maintain required air discharge temperatures.

After the units were installed, it was found that the entire process could be improved. A 10% increase in the amount of water in the base provided an easier mixture to work and one which permeated the fibers more effectively.

The added water allowed the heater temperature to be raised to 250F, with the additional moisture protecting against toasting the fabric. This permitted the material to travel at 12 ft per minute through the dryer, and completely revised the heat balance. The total load under revised conditions was calculated to be 1,150,000 Btu per hr. In order to meet this heat requirement, one of the units was run slightly over rating.

Load Computation Based on 250F and 12 ft per min.

	Btu per hr
Dryer heat loss	334,000
Evaporation (6.96 x 60 x 1000)	418,000
Heat content of water	68,000
Heat content of material	270,000
250 cfm exhausted air (design temp. dif. 250F)	60,000
Total	1,150,000

As the amount of solid coating material and the rate of evaporation are both known, it is a simple matter to time the operation to production requirements and to strike a norm for economical use.

Steam was available at this plant, but it was not used because the cost of the two standard Thermobloc units, completely installed, was less than the cost of running steam lines 300 ft from the boiler room to the dryer and back, plus the cost of additional steam equipment, including pump, coils, fans, etc. Further, the drying temperatures could be maintained with more certainty with direct-fired units than with steam.

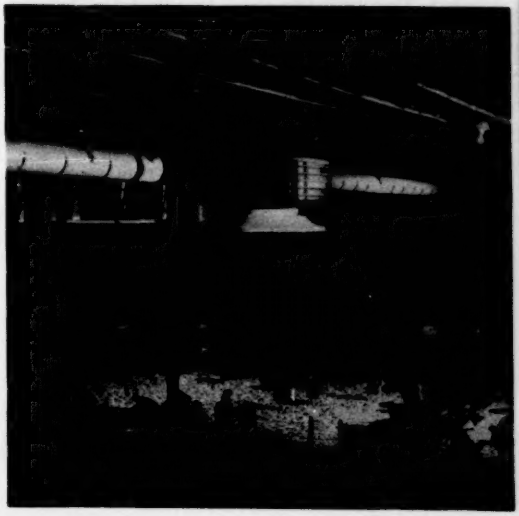
The dry heat of direct-fired units materially assists the evaporation process and makes possible higher speeds of travel of product through the system, and a more uniform finished product.

Diffuser-Vertical Hovers Chicks

Hovering of newborn chicks under shielded stoves has been a poultry-growing practice with the disadvantage of overcrowding and high mortality.

A combination of vertical unit heater and adjustable air diffuser has proved a satisfactory alternative. With the addition of an adjustable diffuser, the downward discharge of air is supplied in a gentle annular stream with induced room air in a ratio of 7 to 9 parts of room air to 1 part of direct supply air. This provides a wide area of controlled temperature with a live quality to the atmosphere, preventing the smothering of chicks in the center of the crowded pen.

Since both diffuser and height of the heater are adjustable, area covered by the warm air stream can be enlarged as chicks grow and its temperature reduced by regulation of diffusers. Shown at right is a Modine unit heater fitted with a W. B. Connor Kno-Draft diffuser.



Auxiliary Heating for Churches

HARRY B. WILSON
Commercial Sales Engineer, The Brooklyn Union Gas Co., Brooklyn, N. Y.

CHURCHES provide a special heating problem which may be solved by the use of unit heaters. Unless the church is used during the week for meetings or socials, it is only occupied on Sundays and then only for a period of two or three hours. Such intermittent heating requires that considerable time must be allowed to raise the temperature of the air from the low point of 40 to 50F to 70F. The problem is greatly increased by the fact that where steam or hot water radiators are used, they are often of insufficient capacity for the space served. Rather than depend upon the slow passage of air over radiators, it is much more satisfactory to "pump" warm air through a minimum of ductwork, if any is necessary, into the space requiring heat. Often one supply grille will be sufficient.

While the virtual elimination of ductwork is not a disadvantage during the pick-up period, there are three reasons why it may result in unsatisfactory heating if it is necessary to use the warm air heating system during the time the space is occupied: (1) the air noise caused by the ejection of high velocity air from the supply grille; (2) the passing of heated air at a high velocity in the proximity of people; and (3) the noise of the motor and fan transmitted through the ductwork may be objectionable in a church even if extensive ductwork is used.

Early Heating Often Necessary

Churches, in general, have insufficient radiation and, as a result, it is often necessary to start firing the coal boiler on Friday and to maintain the fire continuously so that there will be a temperature of 70F by Sunday morning. One authority states that churches, because of their intermittent heating characteristics, should have their heating systems sized 73% greater than that obtained through the conventional method of sizing heating systems for homes.

Church heating presents a diversity of heating conditions. There are times, for instance, when only a few radiators in an office or small meeting room are needed. The operation of a comparatively large boiler for this small load is inefficient. It can be seen that the installation of a large unit heater will make it possible to use a much smaller and more efficient boiler for this relatively small load. If the boiler requires replacement, then it is recommended that the boiler be sized sufficiently large to take care of the few radiators which would be left in the church proper to provide heating during the service. This small and efficiently sized boiler could readily be converted to gas. On the other hand, the larger boiler with its small load during the week and its long pick-up period for Sunday heating, operates at an efficiency which would make the conversion to gas less desirable.

In some cases, the church may choose to leave intact the present heating system and only to install a unit heater to help with the pick-up. Let us consider the application of a 225,000 Btu input unit heater with an equivalent square foot of steam radiation of 770 square feet, to a church having an annual coal consumption of 50 tons. As is typical of most churches, this steam system is greatly under-radiatored for the heating of the church proper. This unit heater, for appearance sake, must be ocated outside the church proper, and this can be done by using an adjoining closet, cloakroom or stairway. Such an installation, operating at a maximum hourly cost of $.21, will reduce the total of 35 or 40 tons of coal required to heat this portion of the church property by an amount dependent of the time which the unit heater is in operation. Depending on the amount of coal saved, there is a related reduction in manpower required to shovel the coal.

Time Required for Heating

Careful consideration must be given to the problem of adequate distribution through a single high velocity supply duct as well as to whether or not heat will be necessary during the services. In the latter case it would be necessary to supply heat from the radiators, since the noise from the air supplied by the unit heater would be objectionable. Assuming that the church proper has a cubical content of 150,000 cu ft and an hourly heat loss of 300,000 Btu, it may be calculated that for an outside temperature of 45F and a corresponding inside temperature of 50F (without benefit of heat from the heating system) that a 225,000 Btu heater will pick up the temperature from 50 to 70F in 0.47 hours.

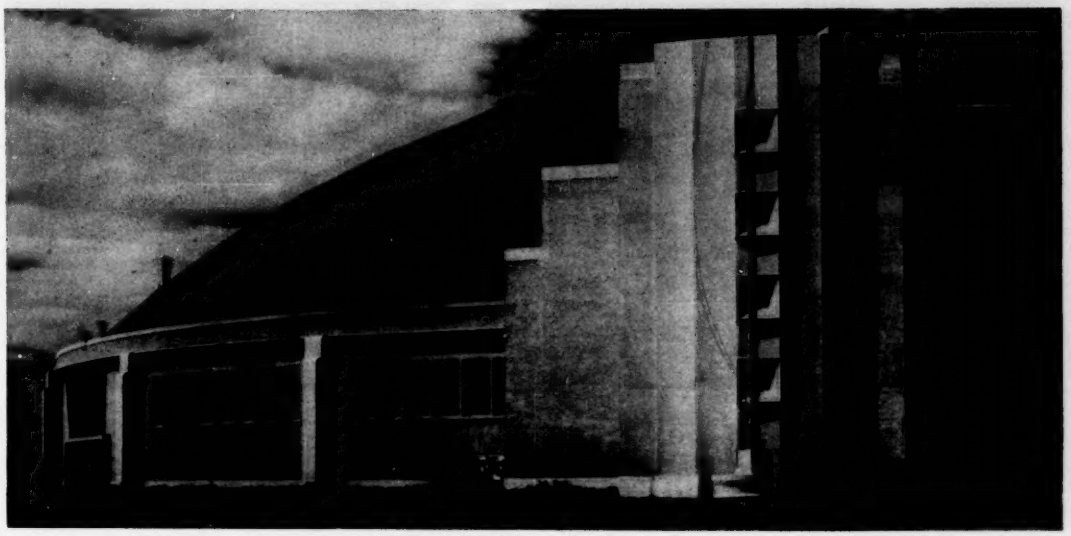
The calculation which follows does not take into consideration all factors, but may be considered as an approximation: Output of heater, 180,000 Btu per hr; mean Btu loss at 60F, 64,000; this gives 116,000 Btu per hr to heat air in room.

The mean heat loss of 64,000 Btu is based on 45F outside temperature and a rise in temperature from 50 to 70F. It is necessary to consider the Btu loss in this calculation, since it is not only necessary for the unit heater to raise the temperature of the air, but to also counteract the increasing hourly Btu loss.

Btu required to raise temperature of 150,000 cu ft of air from 50 to 70F = 150,000 cu ft of air x .075 lb air per cu ft x 0.24 Btu per lb x 20 deg temperature rise = 54,000 Btu.

Time required to raise temperature of air from 50 to 70F = 54,000 Btu/116,000 Btu per hr = 0.47 hours.

This calculation does not allow for the heat absorbed by the furniture, walls, roof and floor. These factors would serve to increase the heating-up time slightly.



Bexar County Coliseum, San Antonio, Texas.

Heating and Ventilating an Arena

The entire balcony of a Texas arena forms the ceiling of vented plenum kept under pressure by 16 industrial heaters.

WHEN the first show of the San Antonio Livestock Exposition was held in the new Bexar County Coliseum, San Antonio, Texas, spectators and exhibitors found the huge oval-shaped structure was equipped with a unique heating and ventilating system that maintains comfortable temperatures the year around.

Designers of the massive building, which is used for all types of athletic events, as well as rodeo productions and livestock exhibitions, overcame many of the problems of heating and ventilating by transforming the space under the balcony tiers into a large air chamber. In this chamber, pressurized air is collected for distribution into the amphitheater. During cold weather, the air is heated by 16 gas-fired Dravo Counterflo heaters. During the summer, only the heater fans are operated to help ventilate the building.

Each of the 5,996 balcony seats, in effect, has its individual heating and ventilating system. In the reinforced concrete risers of each balcony tier are air discharge outlets spaced about 20 inches apart. These outlets, 3-inch pipe sleeves that were set in the forms before the concrete was poured, carry air from the plenum chamber behind the balcony into the arena.

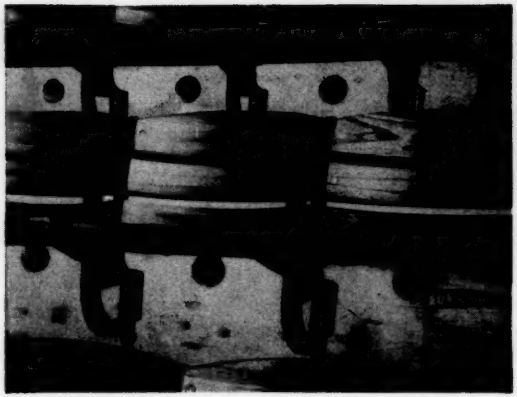
The box seats, which can accommodate 1,560 spectators, encircle the arena of the coliseum. They are supplied with air through 24 ducts extending from the heaters to 40- by 6-inch grille openings above and just behind the box seat area. Similar ducts transport air to the big bandstand over the rodeo entrance at the north end of the building.

One of the main objectives of designers was to construct the building so the entire arena would be perfectly visible from every seat. There are no piers, columns or other view-obstructing structural supports in the building. This made the problem of heating and ventilating the coliseum a more difficult one because of the minimum space available for installation of heating equipment.

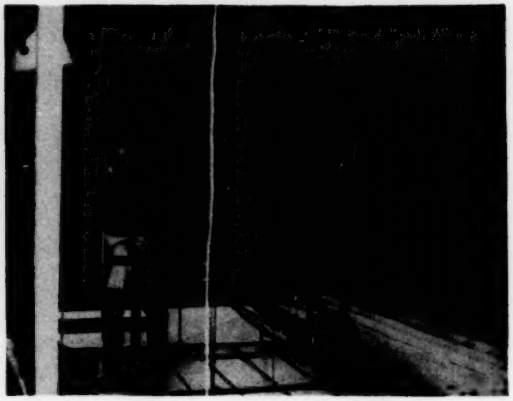
The unused area behind the balcony tiers proved to be an ideal location for the heating machinery and it doubles as the air plenum chamber. The exterior perimeter of the area is walled with 6-inch tile and an airtight seal is constructed between the bottom beam and the plaster ceiling of the concourse below.

The umbrella-like, gypsum composition roof of the structure towers 98 ft above the center of the arena and is supported on steel trusses anchored to piers

Supply ducts to box seats from plenum.



Air vents under balcony seats.



Heater in plenum under balcony.

around the perimeter of the building. It was obvious to the designers that such a high roof would cause stratification of heated air during the winter with resultant high fuel consumption. Conversely, during the summer, the high roof would hamper adequate ventilation, especially under the Texas sun.

To solve this problem, return air ducts have been installed at strategic locations around the perimeter of the building at the top of the balcony tiers, nearly 34 ft above the arena floor and 28½ ft above the air discharge openings over the box seats. Air pulled into these 60- by 12-inch openings by the fans of the heaters is carried back to the heaters for warming and recirculation to the arena. What has been achieved is, in effect, a controlled temperature blanket of air in that portion of the building where comfort is essential. The rest of the space high above the seating areas is unimportant from the heating and ventilating standpoint. The principle of air recirculation at the use level also tends to reduce roof heat losses during cold weather, thereby conserving fuel.

As a means of ventilating the area immediately underlying the roof, which is subject to summertime temperature buildup from solar heat, 30 propeller-type exhaust fans have been installed in a 12-ft wide monitor with automatic shutters. Each fan has a diameter of 54 inches, is powered by an individual ¾-hp motor and can handle 24,115 cfm. Operation of these fans helps in the over-all ventilation of the building, especially important during livestock shows.

The coliseum building is 460 ft long by 264 ft wide. Outside walls are of brick and cast stone, with a large expanse of window area. Heat losses of the big structure were calculated at 10,800,000 Btu per hr based upon the winter design temperature of 20F in San Antonio.

The 16 heaters are spaced equi-distant apart around the oval. They are suspended upside down from steel angles attached to the 6-inch concrete floor slab above them. The area in which the heaters are located, immediately beneath the top tier of the balcony, is 10½ ft high by about 12½ ft wide. This area is above the 20-ft wide concourse of the Coliseum where exhibit booths and concession stands are situated.

Each heater has a capacity of 650,000 Btu per hr and can handle, with its individual fans, a total of 7,000 cfm of air at ½ inch static pressure. The heater fans, and the exhaust fan that provides induced draft for the combustion chamber, are powered on a single shaft by a 3-hp motor.

The entire air supply for each heater is drawn from the arena through the return air ducts. Some of the heaters have two return air ducts and others have three. Air from these ducts enters the base of each heater and is pulled downward by the fans. It passes first over banks of economizer tubes which carry exhaust gases to the 10-inch transite vent stack extending through the roof. The tubes serve to pre-warm the air and cool the exhaust gases. Cooling the gases in this manner has the advantage of extracting the most heat value from the fuel burned in the combustion chamber. After passing over the economizer tubes, which are directly in the path of the incoming air stream, the air then sweeps the heater's stainless steel combustion chamber in which the gas is being burned. Use of stainless steel for the combustion chamber gives the heaters longer service life and enables their installation in an inverted position because no refractory lining is required for the fire box.

Temperature of incoming air is raised approximately 80 degrees during the heating cycle. From the discharge outlet of each heater, the air empties into a supply duct. There is an opening in the top of this duct to allow part of the air to discharge into the plenum chamber behind the balcony. The remainder is transported to the duct openings above the box seats.

The same air distribution pattern is effected for summer ventilating but the gas burners of the heaters are turned off.

Operation of each heater is controlled by an individual thermostat in the plenum chamber. Once the heaters have been turned on, their operation is fully automatic. No attendant is needed.

Maintenance of the heaters in the plenum chamber is facilitated by a 3-ft wide walkway installed along the back wall of the area.

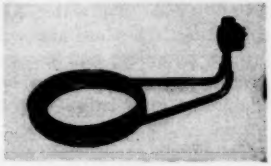
The Coliseum is part of Bexar County's $3,000,000 exposition center occupying a 170-acre site.

NEWS OF EQUIPMENT AND MATERIALS

Use the prepaid postcard opposite Page 96 for securing additional information on items described in this department.

Electric Immersion Heaters

The redesign of two Calrod immersion heaters, for nickel and copper plating baths and for mild sulphuric acid and chrome plating baths, has been announced by Industrial Heating Dept., General Electric Co., Schenectady, N. Y.



Greater flexibility and portability have been incorporated in the new units by replacing the old-style sealing cup with a new junction-box of terminal housing which is vapor-tight. The new terminal housing is easier to repair in the field, and relocation of the unit is more quickly accomplished, they said. In addition, the housing reduces the possibility of faulty connections, and the terminals are readily accessible by removing the housing cover so the terminal connectors to the leads are exposed.

To relocate the heater, the operator has only to remove the cover, disconnect the wire from the heater, place the heater wherever he desires it, and then rewire. Either flexible leads or rigid conduit can be used.

For more information, circle on Inquiry Card, **Item 1**

Powered Roof Ventilators

An addition to their line of powered roof ventilators is announced by The Swartwout Company, Cleveland, Ohio. Of the straight-through type, the new unit features simplified design and low over-all height without sacrificing efficiency.

The ventilator is open only when its propeller fan is operating, the air stream being utilized to open and hold two semi-circular halves of the damper while forcing unwanted elements out of the building. A streamlined fan ring directly above the square-tipped blade propeller guides the air stream smoothly without back-flow.

Given the trade name Whirlout, ventilator is supplied in a wide range of sizes and capacities. It is completely weathertight at all times. Units are described in Bulletin 346.

For more information, circle on Inquiry Card, **Item 2**

Electric Manometer-Flowmeter

A highly sensitive electronic manometer and flowmeter, with no glass or plastic tubes and containing no fluids, is now available from Hastings Instrument Company, Inc., Hampton, Va. The manometer operates from a noble metal thermopile using the same principles which the manufacturer has applied to its vacuum and air velocity measuring instruments.

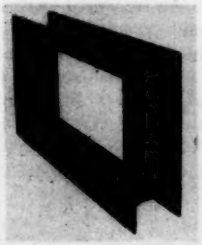
Operation of the manometer is simple. The two taps on the gage tube are simply connected to the two points at which the pressure difference is to be measured. To use the instrument as a flowmeter, the tube is placed directly in the line for low flow rates or connected to pressure taps on two sides of a calibrated orifice for high flow rates.

The instrument will measure extremely low pressure differences and has a dual range of 0.001 to 0.1 inch and 0.1 to 2 inches of water. It may be used for direct indications or attached to a recorder. The calibration and accuracy of the instrument is not affected when long extension cables are used from the gage tube to the meter. This permits remote installation of the gage tube.

For more information, circle on Inquiry Card, **Item 3**

Duct Expansion Joints

A line of practical, low-cost bellows, designated Sola-Flex V-Spans, have been designed and constructed for use in square and rectangular duct connections by Solar Aircraft Co., San Diego, Calif. The company's folded type of fabrication (top view) forms a right-angle corner on the interior of the bellows and an ingenious low-stress corner junction devoid of radii on the exterior. Made of stainless steel, these joints will withstand corrosion and high temperatures. They are intended for use in boiler breechings, turbine condenser connections, air and gaseous duct joints.



The bellows are available in sizes up to 20 feet or more on a side and are built to order. The bottom illustration shows one of the large units.

For more information, circle on Inquiry Card, **Item 4**

Liquid Phase Process Heaters

A line of liquid phase heat transfer equipment to operate at temperatures up to 800 deg has been developed by American Hydrotherm Corp., Long Island City, N. Y.

The equipment is offered as individual components adaptable to large industrial requirements, or as tailored package units for smaller installations. Coal, gas, or oil fired boilers with capacities up to 20,000,000 Btu per hour are designed for high circulation temperatures and for high flow velocity to avoid overheating the liquid transfer medium. Centrifugal pumps are rated up to 1,600 gpm. Package units, mounted on a common frame, utilize electric heaters with capacities from 3 to 75 kw, or gas heaters with ratings of 250,000 to 1,000,000 Btu per hour, and may be adapted for oil firing. Circulating pumps for these units come in sizes of 1½ to 120 gpm.

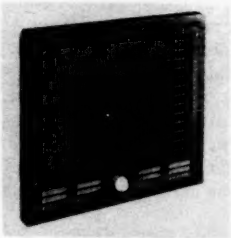
Hydrotherm equipment uses three heat transfer liquids: Hydrotherm 500, 700, and 800. The first is non-flammable, pumpable at room temperature, non-corrosive, and usable up to 600 deg. The second is pumpable at 20 deg, has a very high flame point, and operates up to 650 deg. The last has a low pumping point, is non-corrosive, and can be utilized up to a range of 750 to 800 deg. All operate at atmospheric pressure.

For more information, circle on Inquiry Card, **Item 5**

Electric Panel with Solid Element

An improved electric heating panel, said to have new and superior features, has been developed for radiant heating by Berko Electric Mfg. Corp., Jamaica, N. Y.

The panel employs Pyrex glass sheet backed by a solid conductive coating. Thus, it has no grids or glowing coils to burn out. Two buss bars with multiple silver-clad spring contacts provide sure electrical contact with the two terminating edges of this conductor.



In life tests the units, which are rated at 1,000 watts, have been stepped up to as much as 4,000 watts. Panels in normal operation have been sprayed repeatedly with a stream of water without resulting in any breakage.

Zone control is another feature that makes the panel suitable for auxiliary as well as primary heating. Governed by thermostats, the panels can maintain different temperatures in different rooms of the same building. Heat can be reduced in rooms not in constant use, higher in other rooms such as the bathroom and nursery.

Three types of panels are available: standard, Select-A-Temp (with built-in thermostat), and Select-A-Temp Jr. (for use in small rooms).

For more information, circle on Inquiry Card, **Item 6**

Line of General Purpose Pumps

A new line of general purpose centrifugal pumps has been announced by Economy Pumps, Inc., Division of Hamilton-Thomas Corp., Hamilton, Ohio. Designated as Type SCC, the new pumps are light in weight, easy to handle, install and mount.

The new units are well suited for any small pump application such as small cooling towers, domestic water supply, hot water heating systems and lawn sprinkling. They are also well adapted to booster and process pumping, and sewage or stock pump packing gland water supply. They are also suited to original equipment installation wherever small pumps are required.

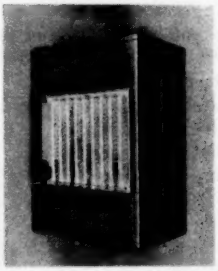
The pumps are of close coupled type. For long, leak-proof operation and to eliminate the necessity of frequent adjusting or gland repacking, they are equipped with mechanical seals. Motors are of the standard open drip type. Standard mounting is vertical; however with the addition of motor feet, the pumps can readily be adapted for horizontal mounting.

Two sizes are available: 2 inch suction x 1¼ inch discharge and 1½ inch x ¾ inch. Both operate at 3,450 rpm. Capacities range to 100 gpm at heads to 120 feet.

For more information, circle on Inquiry Card, **Item 7**

Gas-Fired Duct Heaters

A new line of duct furnaces, designed for use in installations where the air supply and pressure originate at a source removed from the unit, has been developed by Automatic Gas Equipment Co., Pittsburgh, Pa.



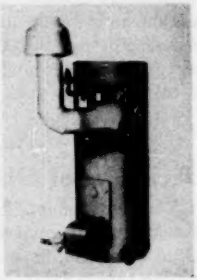
Known as Pittsburgh duct furnaces, they are ideal for use in air conditioning installations where the air ducts are already in place. The basic unit is a standard gas unit heater and equipped with a cast iron heat exchanger and combustion chamber to withstand the corrosive effects of burning gases and moisture. The combustion chamber and heat exchanger are cast in one piece, and the extended heating surface fins on the heat exchanger are cast integral. A built-in draft hood absorbs all excessive chimney action and thereby conserves heat.

The duct furnaces are supplied in sizes from 12,000 Btu input to 200,000 Btu per hr input and are shipped completely assembled with controls and built-in draft diverter.

For more information, circle on Inquiry Card, **Item 8**

Steel Gas Boiler Package

Announced a year ago as an oil-fired automatic heating unit, the National Packet is now available with a certified burner for use with natural, mixed or manufactured gas, from the manufacturer, The National Radiator Co., Johnstown, Pa.



This all-in-one heating plant, which includes a vertical steel tubeless boiler, gas burner, tankless or storage type heater for domestic hot water supply, controls for hot water space heating, and other pertinent regulating devices, has been designed for installation in homes, stores, individual apartment units, roadside diners, motels and similar locations where there is a small-to-medium heating load and economy is desired in first cost, installation and fuel bills.

The first feature claimed by the maker is synchronized operation resulting from all component parts of the new unit being engineered and designed to operate in complete harmony. Another feature is the jet flow of heated water directed through the tankless heater coils actively scrubbing the heating surfaces which is said to result in more efficient heat transfer. The third feature is maximum water-backed heating surface plus extra water capacity, affording maximum radiant heat absorption and greater economy of operation. The boiler has an SBI net rating of 77,000 Btu per hour, or 510 sq ft of water radiation.

The package is available in two types. Either one occupies approximately 4 sq ft of floor space. The flush type (GU-19-WF, top view) with an attractive white enamel jacket has exposed accessories painted black. A high quality, smartly finished white cabinet which completely encloses the unit (GU-19-WE, lower view) is furnished for kitchen or playroom installation.

For more information, circle on Inquiry Card, **Item 9**

Heating System for Sleepers

An electronically-controlled heating system for railway sleeping cars is announced by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

The new system permits car occupants to select the temperature that suits their individual needs, and then automatically maintains this exact temperature, regardless of changes in outside weather.

Circulating hot water is used as the heating medium. Heat is delivered to the car from two sources—floor units along each side of the wall and an overhead system that discharges into the room a constant flow of air heated to the proper temperature by coils over which it passes. The system is controlled by electronic thermostats. Passengers select the room temperature they want with a single control switch mounted on the car wall. From there on the system operates automatically.

The speed with which the new system brings room temperature to the proper degree is due to the sensitivity of the system and the circulation of warm air from the overhead unit. There can be a complete change of air every three minutes. The principal function of the floor heat is to counteract continuously the effect of cold outside walls and windows.

For more information, circle on Inquiry Card, **Item 10**

Industrial Humidity Indicator

The Airguide direct-reading hygrometer is now available for general industrial use, according to the maker, Fee and Stemwedel, Inc., Chicago, Ill. This instrument is said to provide the simplest means yet devised for keeping constant and accurate check on relative humidity.

Easy to read as a clock and reasonable in price, this new addition to the company's line should win acceptance with many types of manufacturers, storage houses, testing laboratories, and other commercial concerns where the maintenance of constant humidity conditions is important. It lists for $6.

For more information, circle on Inquiry Card, **Item 11**

Cooling Towers, 105 to 225 Tons

The new line of LT cooling towers, with capacities of 105 to 225 tons, is announced by The Baltimore Aircoil Company, Inc., Baltimore, Md. The new line is suitable for either indoor or outdoor installation.

Casings are constructed of hot dipped galvanized sheets rigidly braced with hot dipped structurals. Pans are of heavy welded construction, zinc coated after fabrication. Centrifugal fans, four in number, are of the forward curved, low outlet velocity type. Fan motors are drip proof with Type A tropical insulation suitable for outdoor installation. Each pair of fans is driven by separate motors and vee drives. Special non-ferrous surface gives long life and trouble-free service.

The company has also introduced its extended line of UL evaporative condensers in capacities ranging from 105 to 260 tons base rating with F-12 refrigerant. Construction details are similar to the LT line.

For more information, circle on Inquiry Card, **Item 12**

Finned Standard Pipe Surface

A new line of heating surface, adaptable for commercial, industrial or institutional heating, is introduced by Bush Mfg. Co., West Hartford, Conn.

An important construction feature is the use of 1¼ or 2 inch standard size steel pipe, affording simplicity in the piping and fitting problem. This surface is also constructed of heavy wall, 1⅛ inch O.D. copper tubing, with aluminum fins.

Complete specifications are contained in bulletin 535, available upon request.

For more information, circle on Inquiry Card, **Item 13**

Chilling Stabilizes Steel

Dimensional stabilization of steel, ordinarily requiring years of seasoning, is now being effected in a matter of hours by chilling to —120 deg in Sub-Zero industrial chilling machines, manufactured by Sub-Zero Products Div., Deepfreeze Distributing Corp., Cincinnati 29, Ohio.

In ordinary heating and quenching of steel, not all the austenite is transformed to martensite. This unchanged portion causes dimensional growth and warp over a period of time. However, it has been found that repeated cycles of heating to room temperature and chilling to 120 deg below zero brings about 100% transformation of austenite to martensite. As a result of this change, complete stabilization is obtained. At the same time greater hardness, strength and ductility is obtained.

This application of chilling has been found effective on any steel part where dimensional stability is important. One valuable application is in the seasoning, setting and counter-annealing of gages.

For more information, circle on Inquiry Card, **Item 14**

No-Turbulence Pipe Coupling

A new style compression pipe coupling which practically eliminates turbulence at the joint is being manufactured by Morris Coupling & Clamp Co., Ellwood City, Pa.

The coupling is made up of three parts: a gasket made of the material best suited to give protection for the specific job application, steel inner sleeve with precision die-cut teeth placed eccentric to the gasket teeth to form a complete seal when the outer shell is tightened, and steel outer shell made of zinc-coated steel or corrosion resistant metals when required, with zinc-coated washers, bolts and nuts.

The coupling is made in sizes from ½ to 14 inches standard pipe sizes, including intermediate tube sizes. It will couple ferrous to ferrous or ferrous to non-ferrous materials. It couples threaded to non-threaded pipe as easily and safely as threaded to threaded. Usefulness for the coupling can be found in every major industrial, agricultural, commercial, institutional pipe line operation where liquids or semi-solids are to be carried under low or high pressure. A technical bulletin is available.

For more information, circle on Inquiry Card, **Item 15**

Acid-Proof Plastic Pipe

The addition of Tuffstuff to its line of industrial plastics is announced by Clopay Corp., Cincinnati, Ohio. Tuffstuff is a rigid, corrosion-resistant plastic piping that is expected to find wide use in the chemical, petroleum, mining, food processing and plumbing fields, and should have value in replacing critical metals now used in these fields.

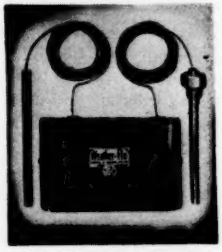
Extruded in standard pipe and tubing sizes, the plastic is actually an unplasticized polyvinyl chloride compound. It is impervious to concentrated acids; alkalis and many solvents. It is rigid but not brittle. Welding, cementing and bending may be easily accomplished by the usual techniques. It is relatively non-toxic, odorless, tasteless and weighs less than 25% as much as steel.

For more information, circle on Inquiry Card, **Item 16**

Indoor-Outdoor Heat Control

The Weather-Flo indoor-outdoor modulating heating control is announced by Automatic Devices Co., Inc., Western Springs, Ill.

An outdoor weather reading in combination with a temperature measuring bulb in the heating system changes the rate of heat flow with every change of the weather in anticipation of the heating needs of the building. A built-in fan or pump switch provides for a continuous regulated flow of heat to the building as long as weather conditions require any heating. Heating lags caused by overshooting and underheating are said to be eliminated. This gives a constant, uniform heating level at the desired temperature from the least amount of fuel.



Completely adjustable on the job for different heating system design temperatures, different operating temperature ranges, different minimum temperatures and heat cut-off makes this a universal unit for all jobs. Ease of adjustment is assured by having the dial markings of each of the four adjustment dials calibrated in actual temperature settings.

Simple to install, the control is designed for operation with all fuels and with all heating systems, including radiant panel systems.

For more information, circle on Inquiry Card, **Item 17**

Easy Measuring of Pipe Lines

The Model 200 Rolatape, an instrument with a wheel exactly 2 ft in circumference, which accurately measures and records as it is rolled over distance to be measured, is now available from Rolatape, Inc., Santa Monica, Calif. This device is said to make measuring as easy as walking (top view). The instrument registers up to 100 feet, then repeats cycle.

The instrument has been extensively field tested and is being used by the plumbing and other contractors for field work such as locating valves and mains, job layout and rechecking, as well as general estimating work. It measures line to line or wall to wall, around curves and contours easily and accurately. Users say its operation permits operator to do the work of two men, and in much less time. It weighs 2¾ lb, and folds up conveniently to 8x8x2 inches (lower view).

Traction is provided by two Neoprene tires on circumference of wheel, which is 7⅝ inches in diameter. Tires are precision ground and are specially designed to hold their accuracy even after miles of severe usage. Total distance is recorded in feet and inches by the built-in totalizer and recessed scale on wheel circumference. Clearly audible click every 2 feet permits running count. Loud bell tone indicates 100 ft total, at which time totalizer repeats cycle. May be used for longer distances by counting bell signals. Handy knob allows operator to reset indicator for each new measurement.

For more information, circle on Inquiry Card, **Item 18**

Forced Convection Heaters

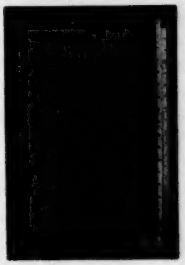
A line of forced draft gas and electric heaters is available from Kilbury Mfg. Co., Lawndale, Calif., under the name Homogenator heaters. They are for use singly or in batteries for any type of space heating, the advantage claimed being that the forced draft eliminates stratification of heated air at ceiling.

The electric heaters are available in a number of models, some of which are designed for unit operations, others for connection to ducts. Illustration shows a unit with connection for ducts. The electric units are available in sizes with capacities from 30,700 to 45,000 Btu per hour. Gas units are made in four models with capacities of 40,000 and 50,000 Btu per hour.

For more information, circle on Inquiry Card, **Item 19**

Heavy Duty Finned Heating Coil

A heavy duty heating coil has been placed on the market by Industrial Mfg. & Engrg. Co., Chicago, Ill. It consists of a single header which has two compartments, one for live steam, the other for condensate. To the steam chamber are welded standard ⅜ inch pipes which are inside standard 1 inch pipes, the latter being welded to the condensate chamber. The steam flows from the steam chamber through the ⅜ inch pipes and escapes into the 1 inch pipe where it is reduced to condensate, flowing back through the condensate space to the return line.



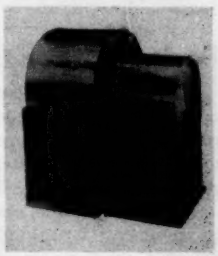
Among the features are long life, as evidenced by earlier types of pipe coils that gave many years of service; individual expansion and contraction of each pipe, eliminating possibility of strain on other pipes; galvanized fin and pipe construction, increasing its resistance to corrosion, and danger of freeze-up reduced to a minimum.

The coil can be furnished made of standard steel pipe with steel fins or extra heavy wrought iron pipe with steel fins or admiralty metal tubes and steel fins. Headers of heavy steel plate welded. There are four widths, three coil depths and fifteen different lengths. A 12-page catalog is available.

For more information, circle on Inquiry Card, **Item 20**

Fan Can Be Used Outdoors

A centrifugal fan arrangement with weatherproof hood over the motor drive section that can be installed outdoors without further protective enclosure is announced by The Trane Company, La Crosse, Wis.



This fan, said to be an exclusive with this manufacturer, is available with wheel diameters as large as 60 inches, in backwardly-inclined and forwardly-curved, single width, single inlet models in Class I construction.

Designated as Arrangement 10, the fan has high-efficiency, low noise, and low horsepower characteristics.

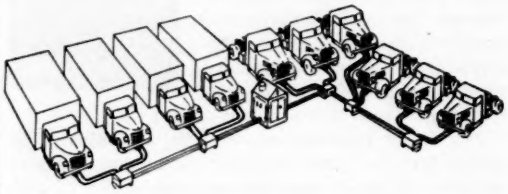
For more information, circle on Inquiry Card, **Item 21**

Heater for Bus Parking Lot

A parking lot heater for protecting bus and truck blocks from freezing and keeping them warm during non-use hours in the winter has been developed by Vapor Heating Corp., Chicago, Ill.

This oil-fuel heater is encased in a 4x4 foot metal housing (top view). Weighing 1,500 pounds, it can be easily moved about from one point to another. Its capacity is 250,000 Btu per hour, enough to protect 10 buses or 20 trucks during cold weather (lower view).

In the unit is a Vapor-Clarkson hot water heater. Hot water is continuously circulated though the buses and trucks connected to the system by a 1½ hp circulating pump. When the circulating water temperature drops to 140F the heater starts and continues to operate until the water in the system reaches 170F, at which point it stops until the temperature again drops to 140F. When operating, the heater burns 2½ gallons of fuel oil per hour.



It takes about 2 minutes to make the three connections on the bus or truck motor block; snap fittings are used which eliminate waste of water or mess in making connections.

When no buses are connected to the heater and the unit is on, the heater cycles on and off and continues to circulate the warm water through al' the hoses to protect them from freezing and to keep the equipment ready to be used immediately.

For more information, circle on Inquiry Card, **Item 22**

Packaged Conditioning Units

Multi-package air conditioning units of 40 and 60 tons capacity, remote water-chilling equipment, and a packaged heat pump were displayed for the first time at the All-Industry Refrigeration Show by Typhoon Air Conditioning Co., Brooklyn, N. Y.

The multi-package systems feature ease and economy of installation and simplicity of maintenance. Flexibility of cooling supply is accomplished by the Gradu-Matic control, enabling the operator to put one section of the multi-package into action at one time, according to the heat load.

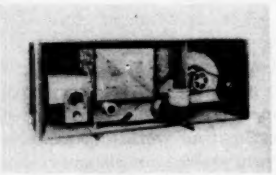
Water-chilling equipment in standard 10, 15, and 20 ton highsides are combined with water-chilling units into one compact unit. The chilled water is pumped to attractive floor model or ceiling mounted air handling units, suitable for hotels, motels, offices, and other similar installations.

The Prop-R-Temp heat pump, developed over the past three years in Florida, is claimed to be a compact and efficient application of the heat pump principle in a modern, streamlined package.

For more information, circle on Inquiry Card, **Item 23**

Suspended Oil and Gas Heaters

A suspended oil fired unit heater is available from Auburn Burner Co., Auburn, Ind., in a variety of sizes. Units have centrifugal blower and a tubular-type heat exchanger as shown in the illustration. The burner is attached at the opening shown at the left. A factory designed and installed refractory combustion chamber is said to insure high efficiency. Flue outlet may be furnished on either the right or left side.



All of the models available may be furnished with gas burner and controls with the same capacities.

Heaters are available in seven sizes with capacities ranging from 80,000 to 400,000 Btu per hour output. The smallest size, however, is not of tubular construction as illustrated.

The units may be hung overhead, leaving the floor space free for useful occupancy.

For more information, circle on Inquiry Card, **Item 24**

Acid-Proof Pipe Joint

Development of a new type wrapped joint for Haveg and other resin-base pipe, known as the Duro-Joint, is announced by Electro Chemical Engineering & Mfg. Co., Emmaus, Pa. The joint is composed of a spiral wrapping of glass cloth and Lecite acid- and alkali-proof furan resin cement using a special technique and is equal in strength and chemical resistance to the pipe itself. The joint replaces, in many instances, the flange type joint which is subject to corrosion, and also may be used to repair broken pipe or to armor porcelain or stoneware.

The joint can be made in the field without the use of heat or special equipment. Joints were tested without failure under hydrostatic pressure pulsating rapidly from 0 to 350 lb per sq in. The joints were then placed under 100 lb steam pressure and, while hot, the pressure was released and the joint immersed at once in water at 60 deg. The joints were unaffected by this shock treatment.

For more information, circle on Inquiry Card, **Item 25**

Asylum Wall Closet Fittings

Designed to prevent losses of clothing and clogged drainage lines, which frequently occur in institutions where mentally ill patients flush clothing and personal belongings into drainage lines, a series of wall closet fittings announced by J. A. Zurn Mfg. Co., Erie, Pa., simplifies the removal and recovery of such articles, while substantially reducing maintenance time-costs.

A four-inch cleanout, as an integral part of this new type wall closet line, is the means by which such savings are accomplished. The cleanout affords quick and easy access to drainage line at the point where such access is needed without necessitating removal of the fixture or disassembly of any part of drainage line in order to clear the obstruction. It may be used to mount wall type closets of any manufacture. The fittings are also suited for prisons, reformatories, and similar institutions.

For more information, circle on Inquiry Card, **Item 26**

Odor Removing Filters

The D. O. air filter for odor and dust removal is announced by Research Products Corp., Madison, Wis. This filter has been treated with X-56, an odor removal ingredient announced by the company on these pages recently.

The filters have a high performance dust filtering medium to which the treatment has been added to remove objectionable household and other odors such as are carried through the house by the circulation of air in a forced warm air system.

The units are available as filters in five sizes ranging from 15x20 inches to 20x25 inches, and also in five sizes of the pads themselves in the same sizes.

For more information, circle on Inquiry Card, **Item 27**

Sprayed Coil Dehumidifiers

The addition of sprayed coil dehumidifiers to its present line of equipment is announced by Kennard Corp., St. Louis, Mo. These units are available in a large number of sizes and are of galvanized construction with copper tube and copper finned coils for long life.

These dehumidifiers offer the advantage of washed air at all times. Wetted surface of the cooling coil for better heat transfer and closer approach of the wet bulb temperature to the dry bulb temperature is an additional feature.

The dehumidifiers are also suited for use as an evaporative cooler for off-season loads.

For more information, circle on Inquiry Card, **Item 28**

Measures Dust in Gas

The GPPC gas dust analyzer, recorder and alarm has been developed by General Power Plant Corp., New York, N. Y. This instrument is designed to record the amount of total suspended solids or dust particles in gas streams such as those from blast furnace gas lines, fly-ash in boiler smokestacks, effluent of process stacks for paper, pulp and cement mills in grains per cubic foot. The unit, which is of the photoelectric type, consists of the lamp and reference cell and the analyzing cell with their housings, the recorder, and drawings required for the construction of the sampling tube.

For more information, circle on Inquiry Card, **Item 29**

Bellows Expansion Joints

A comprehensive line of bellows type expansion joints for piping have been made available by Solar Aircraft Co., San Diego, Calif., in two types—the fabricated type and the convoluted type. The former is most generally applicable to heavy industrial problems while the latter is intended for the aircraft field or similar applications where light weight is required.

The bellows are normally manufactured from stabilized stainless steel and all industrial types are welded to conform to API-ASME code standards. Where special conditions of temperature, unusual corrosion problems and extraordinary high frequency vibrations occur, bellows can be made of a variety of materials to accommodate these conditions and can be supplied on order. All standard industrial flanged end fittings are of forged steel and in accordance with ASA Standard B-16e-1939. Pipe ends for welding are furnished in proper schedule of wall thickness conforming to piping code. Special end fittings of various alloy materials, including stainless, are also available on special order.

Among the various models available are the standard expansion joint flanged both ends; the joint with weld end on one end, flanged on the other end; those with pipe weld ends on both ends; the hinged joint for angularity in one plane without end thrust; the tied joint (illustrated top view) for offset in plane without end thrust; the Gimbal joint for both angularity and offset in any plane without end thrust; and the balanced joint to accommodate axial movement without end thrust (illustrated lower view).

The joints are made in pipe sizes from ½ to 72 inches in diameter. A comprehensive engineering bulletin, No. 51, 40 pages, is available.

For more information, circle on Inquiry Card, **Item 30**

Power Units for Ventilators

The Allen Staxauster, designed for either direct (illustrated) or remote drive, has undergone design improvements according to the manufacturer, Production Planning Co., Rochester, Mich. The device is intended for either new construction or conversion of all types of roof ventilators into powerful exhaust or air supply units.

In the direct drive type, as shown, the motor is placed directly in the air stream in line with the fan and both the fan and motor assembly rigidly supported by an inner steel band which also serves as reinforcement for the duct section. Motors are totally enclosed, ball bearing fan duty type, connected directly to the propellers on direct drive.

The remote drive type is similar except that the motor is contained in a box-like structure connected to the duct system and with a belt drive to the fan pulley. Open-type motors are used. Explosion-proof motors can be furnished.

An inspection door of ample size is incorporated in the shell, permitting easy access for inspection, lubrication and cleaning.

The direct drive units are available in 26 sizes with diameters ranging from 12 to 42 inches and capacities from 890 to 21,000 cfm at zero static pressure. Remote drive types are available in 22 sizes with diameters from 15 to 42 inches and capacities from 1,250 to 20,000 cfm at zero static pressure.

For more information, circle on Inquiry Card, **Item 31**

Pipe Joint Cement in White

Its plastic adhesive and pipe joint cement, Plasgon, is now being produced in white by Samuel Cabot, Inc., Boston, Mass. This cement is a permanent flexible seal for pipe joints and gaskets, particularly where vibration is a factor.

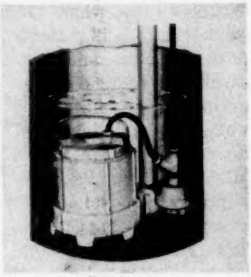
In the past, the cement was black and its usage was limited to areas where color was not important. With the new white product, transparent in use, of the same strength and adhesive qualities as the black, the makers have greatly broadened the field of use.

The cement is a flexible, plastic compound that stays flexible. It absorbs shocks and is not dislodged or affected by vibration or jarring. It is impervious to water and proof against gasoline, kerosene, glycol, oil and steam. It resists heat up to 350 deg.

For more information, circle on Inquiry Card, **Item 32**

Submersible Utility Pump

A completely submersible utility pump is now available with applications of interest to maintenance, operating and engineering executives of industrial plants. Principal uses of this pump include sumps found in factory layouts, such as in boiler room pits, underground utility installations, elevator pits and other low areas; utility purposes such as draining flooded areas and buildings, pumping out new excavations for buildings and ditches, and draining of tanks and vats.



The automatic liquid level control switch eliminates need for a float. This switch, which has no moving parts exposed to water, turns the pump on automatically as a result of air pressure created by water rising in the switch skirt, moving a diaphragm which in turn trips the switch. Water, silt or other debris cannot foul the switch. The low turn-off point is obtained since pumping action sustains switch operation and thereby makes it possible to pump a sump dry within $\frac{5}{8}$ inches of the bottom. In sump usage, since the pump is submersible, the entire portable unit can be installed right in the sump in a few minutes, rather than having the motor on top of the sump supported by a permanent mounting. The motor is hermetically sealed in oil, requiring no oiling or greasing. The maker is Kenco, Inc., Lorain, Ohio.

This pump is also ideal for utility purposes since it weighs only 50 pounds and can be moved and placed in operation very quickly. It is compact, measuring $9\frac{1}{2}$ inches high and a maximum diameter of 13 inches. Despite its small size, it has a capacity of 3,300 gph.

Model P-109MA is both manual and automatic, provided with a thru-cord switch which permits manual starting at any depth of water. After starting manually, cord switch can be set to the automatic position and pump shuts off automatically. It lists for $95.50.

For more information, circle on Inquiry Card, **Item 33**

Rustproofing without Coating

An economical method of preventing rust and corrosion of metal parts in the presence of air and moisture is provided by VPI crystals, a slightly volatile amine nitrite now being available from Shell Oil Co., New York, N. Y. This corrosion inhibitor is for protecting metal parts, assemblies, instruments and finished products during shipment, storage, and through various processing steps.

Being slightly volatile at atmospheric temperatures, the crystals give off vapors which are carried by convection and diffusion to all surfaces of the metal, where they condense to provide a thin protective layer.

The powder-like substance can be applied by placing it in a package enclosing the parts to be protected, by blowing it into an area to be protected, or by putting it into a water or alcohol solution. An unusual characteristic of the substance is that it will arrest corrosion at any advanced stage.

For more information, circle on Inquiry Card, **Item 34**

PRODUCT INFORMATION SERVICE

Use the postage-free postcards below for further information on:

- **News of Equipment and Materials**
- **New Catalogs**

Circle the Item Numbers in which you are interested and print clearly your name and address with title.

NEW CATALOGS

HOT WATER BOILER PROTECTION

A 4-page, standard size brochure has been published as Bulletin F174-516 by Watts Regulator Co., Lawrence, Mass., and describing its line of boiler relief valves for pressure protection for hot water heating boilers. Information includes comprehensive description of the valves, how they work, and a table of ratings of the various sizes. .....Item 35

REFUSE AND COAL BURNING

A 24-page brochure on the burning of refuse or coal separately or in combination, has been published by Detroit Stoker Co., Detroit, Mich. Elaborately prepared, the booklet lists all of the different kinds of refuse such as wood shavings, sander dust, corn cobs, coconut shells and many other types of refuse which can be burned separately or in combination with the company's stokers, followed by an illustrated list and description of such installations. .....Item 36

PACKAGED ELECTRIC HEATERS

A 4-page folder entitled Chromalox Packaged Electric Heaters has been issued by Edwin L. Wiegand Co., Pittsburgh, Pa., illustrating the various types of packaged electric heaters available from that company and their application. These include immersion and circulation heaters with built-in controls. They are of interest to contractors because of their ease of installation, small space for stocking and the profitable market, while the sales appeal lies in their long life and freedom of maintenance. .....Item 37

AIR VALVES FOR STEAM SYSTEMS

Bulletin 117, devoted to its line of air venting valves, has been issued by Gorton Heating Corp., Cranford, N. J. These valves, designated as vapor equalizing valves, are available for installation on mains as well as individual radiators and are for use with steam systems regardless of the type of fuel used. .....Item 38

REFRIGERATION EQUIPMENT

A 4-page standard size bulletin, 140, has been issued by the Whitlock Mfg. Co., Hartford, Conn., and devoted to its refrigeration equipment, including condensers, chillers, pipe coils, coolers and receivers. .....Item 39

HOSE REELS FOR STANDPIPES

A 6-page bulletin, 080751, has been published by Wirt & Knox Mfg. Co., Philadelphia, Pa., and covering its line of quick-acting hose reels for standpipe installations. .....Item 40

VAPOR TRANSFER THROUGH WALLS

Bulletin 220, standard size, 20 pages, entitled Vapor Barriers for Dehumidification, has been issued by Pittsburgh Lectrodryer Corp., Pittsburgh, Pa. The bulletin is a report by Professors E. R. Queer and E. R. McLaughlin of The Pennsylvania State College, and constitutes a simplified but comprehensive study of vapor barriers and the calculation of vapor transfer, together with a table on permeance of building materials. Price, $1.50. .....Item 41

CONVECTOR HUMIDIFIER

Form 851, four pages in envelope stuffer size, listing sizes and capacities of the company's convector humidifier, with construction description, is available from Maid-O'-Mist, Inc., Chicago, Ill. Item 42

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51									

Nov. H/51

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VALVES FOR POWER PLANTS

A handy, quick reference guide to its cast and forged steel valves primarily for power plant installations, including industrial, is now available from Edward Valves, Inc., East Chicago, Ind. Designed for easy reference and identification, the new bulletin illustrates and describes only those steel valves applicable to power plant use. Other valves are listed, but with brief description only.....**Item 43**

SAFETY RELIEF VALVES

A 16-page bulletin, with charts showing the capacity required from safety valves to give 100% protection in case of pressure reducing valve failure, is available from Marine and Industrial Products Co., Philadelphia, Pa. Also shown is a gas volume-weight chart for determining volumes per pound of gases with various specific gravities at various pressures and temperatures. Many models of safety valves are illustrated, together with tables giving valve capacities in steam, air and gas at various pressures. .....**Item 44**

PACKAGED STEAM GENERATORS

A four-color, 16-page catalog, profusely illustrated with photographs, cutaway and schematic drawings, has been issued by Superior Combustion Industries, Inc., New York, N. Y., covering its line of packaged steam generators. Easily read charts and tables provide engineers with essential data, dimensions, specifications, and test results. It also discusses such subjects as induced draft; dry steam; 4-pass down-draft design; flexibility of operation; and oil, gas and combination oil-gas burning equipment. .....**Item 45**

SHUTTERS AND DAMPERS

Catalog No. 51, standard size, 16 pages, has been issued by Elgo Shutter & Mfg. Co., Detroit, Mich., and devoted to that company's line of ventilating specialties including automatic shutters and back-draft dampers, stationary shutters, hand-operated shutters, motorized shutters, automatic ceiling shutters, automatic ceiling dampers, hand-operated ceiling shutters. Catalog is comprehensive in giving illustrations, dimensional and constructional details. .....**Item 46**

BOILER ROOM MODERNIZING

An 8-page case history telling of the modernization and expansion in the boiler room of Falstaff Brewing Company's plant in St. Louis, is available from The Hays Corp., Michigan City, Ind. New equipment added, building changes, uses for steam and boiler conditions are described and illustrated. In addition, text, photographs and schematic diagrams trace the operation of the combustion control system. Results obtained with new equipment are listed. ..**Item 47**

GLASS INSULATION FOR PIPING

A new booklet entitled Foamglas Insulation for Piping and Process Equipment is available from Pittsburgh Corning Corp., Pittsburgh, Pa. This well illustrated 24-page booklet, G-1839, discusses the advantages of Foamglas, lists its properties, gives typical data for cold, intermediate, and hot applications, details for insulating tanks, ducts, removable covers, and tank heads. .....**Item 48**

COMPLETE CONTROL CATALOG

A complete and informative catalog, F-1753-3, 46 pages, of thermostats, motor-operated valves and accessories for heating, ventilating, and air conditioning applications, is available from Barber-Colman Co., Rockford, Ill. Catalog is a handy reference when selecting control equipment. .....**Item 49**

MULTI-STORY AIR CONDITIONING

Technical data for laying out year-round air conditioning for offices, hotels, hospitals, apartments and other multi-room structures are contained in a 36-page bulletin, DS-369, on its Custom-Air system, published by The Trane Company, La Crosse, Wis. It outlines criteria for design of the ventilation air system; room unit selection and performance data; roughing-in dimensions; mechanical specifications, and control systems. ....**Item 50**

PRODUCT DESIGNERS' CATALOG

A 16-page catalog, CMH-123, prepared especially for product designers' use is published by Chicago Metal Hose Corp., Maywood, Ill. It was prepared to give complete description and specifications of products for original equipment manufacturers' use. It includes information on metallic bellows of stainless steel, brass, bronze and other alloys. Complete specifications giving the pertinent characteristics of the complete size range of these bellows which are used extensively in many types of control, regulators and thermostatic devices are given. For applications such as steam traps, instruments, valves, shaft seals and many others, a guide to the proper selection can be obtained from this bulletin. Also included is complete information on the company's several types of flexible metal hose and tubing. Data contained covers a wide range of types from those types used in the most critical aircraft applications to flexible can spouts. .....**Item 51**

Product Information Service

Use the postage-free postcards below for requesting further information on products mentioned in the following sections of this magazine:

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What Would You Do?

Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

This Month's Problem

At our factory we are planning to install a large outside underground fuel oil tank to supply oil burners. The location favored for the tank is one where some ground water may be present. Is it best to abandon this proposed location or are there some special safeguards to follow?

THE current industrial plant problem is one that is faced by many industrial plants that use fuel oil. Therefore, the information received in answer to this question should prove of general interest.

Should you have a problem that you would like to see discussed in this department, or if you have some comments that you would like to make regarding a problem scheduled for future discussion, you are invited to write to the Editor. Such letters will be most welcome. The following information was supplied by an engineer who has had extensive experience in this field.

Solution

The ideal location of a fuel oil storage tank would be in firm dry earth, free of all rocks, moisture and substances corrosive to steel. However, ideal conditions are seldom encountered, and where surface water may be met, the following disadvantages must be realized:

(1) The increased deterioration of the storage tank, due to the corrosive action of water mixed with harmful substances in the soil that will result in premature storage replacement.

(2) The additional cost of installation due to pumping the pit, anchoring to prevent the tank from floating, and special care of installation.

(3) The possible greater settling and movement of the storage tank with resulting pipe strains.

(4) Where tank heating is necessary for the more viscous grades of fuel oil, a greater heat loss will occur from the storage tank. However, if the site as selected contains surface water, it is possible to obtain satisfactory results although added measures must be taken to retard tank corrosion. The storage tank should be thoroughly cleaned and coated on the outside with two coats of red lead and coated at the site with hot tar, asphalt or other equivalent rust-resisting material.

A suggested method for anchoring tanks is shown in Fig. 1. The general procedure is to set the tank on a poured concrete slab, and attach the tank to this slab with steel straps or rods. The concrete slab must be reinforced with ½ inch diameter steel rods placed on centers not greater than 12-inch. The rods should be placed near the bottom of the slab where the slab is in tension. Reinforcing rods are placed crosswise in the concrete. When the concrete is poured, the anchor rods are set in place and are anchored into the slab by looping the end around the horizontal rods embedded lengthwise in the concrete on either side of the tank. One inch diameter steel anchor rods should be placed on approximately 5 ft centers along the tank length.

The weight of concrete necessary to secure the tank is a matter of judgment. It should be between the maximum weight necessary to offset the maximum clear water and the weight to offset the maximum amount of ground water that may be encountered in the special loca ity. The weight of concrete in air varies from 110 to 155 lb per cu ft, according to the material used. The commonly used average is 150 lb per cu ft for stone concrete.

However, the actual weight of concrete when immersed in water, is equal to the difference in weight between one cubic foot of concrete at 150 lb and one cubic foot of water at 62.5 lb. The effective weight of concrete is therefore 87.5 lb per cu ft. The tank is buoyed up by the weight of the displaced water. This is equal to the capacity of the tank in gallons multiplied by 8.3 lb. From this total displaced weight there may be deducted the weight of the tank, the weight of the concrete manhole enclosure, if present, the effective weight of the earth fill on top of the tank, and in the judgment of the designer any equipment that may lend its weight for this purpose. When these items have been deducted, the resulting net weight of displaced water divided by 87.5 will give the cubic feet of concrete necessary.

When the concrete is placed over the tank, the full weight of the 150 lb per cu ft may be used in calculat-

Problem to Be Discussed

December Issue

How do you determine what per cent of lubricating oil of one viscosity must be mixed with that of another viscosity in order to obtain an oil of desired SSU grade? Is there a formula or chart for solving such problems?

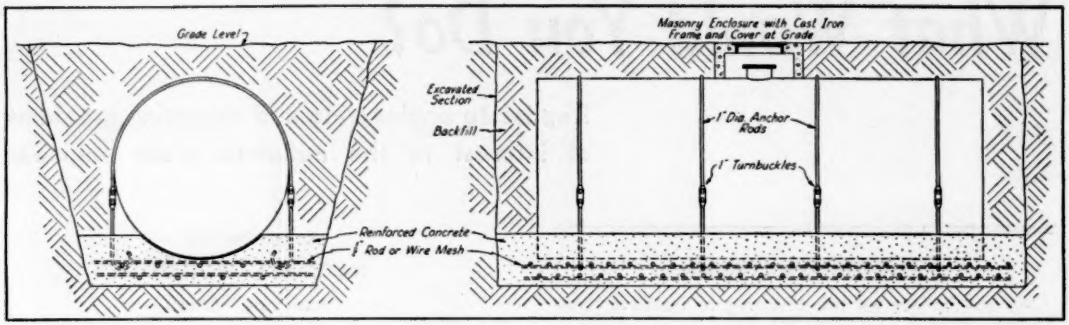


Fig. 1. Details of a suggested method for anchoring fuel oil storage tanks.

ing the volume of concrete necessary. The top of the concrete would be in tension and the reinforcing rods should, therefore, be located near the upper surface of the slab. The concrete slab should extend a minimum of one foot on all sides of the tank. The slab should, therefore, be at least 2 ft greater in length and 2 ft greater in width than the tank. Also, concrete slabs may be used to prevent cutting.

Practically all underground storage tanks of 3,000 gal and greater capacity are equipped with access manholes for inspection, cleaning and repair. Standard manholes are 16 inches in diameter and are made up of a manhole flange welded to the tank, and a steel cover plate which is bolted to the tank flange. An oil-tight gasket should separate the two surfaces.

To provide access to a buried tank, it is customary to install a masonry or poured concrete enclosure around the manholes and to extend the enclosure to the grade level for receiving a heavy cast iron frame and cover. The inside dimensions of the masonry enclosure should be approximately 3 ft wide and 6 ft long.

E. F. Opperman,
Field Engineering Division,
Stamford, Conn. *Petroleum Heat and Power Co.*

October Question

The problem posed by the question outlined in the October issue of HEATING AND VENTILATING regarding the possible recirculation of air from spray-coating booths is restricted specifically to the vapors from the liquid portion of the paint. It is stipulated that the solid portion or pigment of the paint is to be removed. While the removal of the pigment from the exhaust air stream is more difficult that many people realize, if it is removed satisfactorily, the determination of the permissible limit of air recirculation reduces to rather exact and fundamental principles[1,2].

Even though the problem in question is easily solved, the practice of recirculating air from paint-spraying booths is uncommon and subject to justifiable criticism. It should be considered only in rare instances where (1) heating the exahusted air actually creates a financial burden, (2) the pigment is removed adequately from the air, (3) the relation of the spraying operations to the booth ventilation rate is such as to result in fairly low concentrations of vapor in the exhausted air, and (4) where it is highly unlikely that a paint with a more toxic liquid component may be substituted accidentally or unknowingly for the one on which the recirculation was based.

The percentage of air that may be recirculated from a paint-spray booth is given by the following expression:

$$P = \frac{100}{R + 1} \qquad (1)$$

where P is the maximum percentage of air which may be recirculated and R is the ratio of the air required for dilution to that required for booth ventilation as explained later.

Concentration of the vapor in the exhaust air is a function of the booth ventilation rate and the spraying rate. When the atmospheric conditions in the booth and exhaust system have attained equilibrium, the exhausted air is removing the paint liquid at about the rate that it is being sprayed. Consequently, the concentration in the exhaust duct for any paint liquid can be calculated. It is given conveniently by the expression:

$$C = \frac{4.1 \times 10^8 \times SpGr}{Q \times MW} \qquad (2)$$

Where C = concentration in parts per million of the paint liquid vapor in the exhausted air
SpGr = specific gravity of the paint liquid (water = 1)
Q = booth ventilation rate in cubic feet of air per pint of paint liquid consumed
MW = molecular weight of the paint liquid in grams.

For the sake of convenience, the required dilution rates (or ventilation rates to dilute the vapors of the liquids in question to the prescribed concentrations) for some of the more common paint thinners are given in Table 1. The rates are given as required to dilute the vapor to both the level safe for reasons of health and the explosion hazard.

[1]Jung, Francis D., Recirculating Spray Booth Exhaust, HEATING AND VENTILATING, May, 1946, pp 62-64.
[2]Brandt, Allen D., Ventilation for Spray Painting, *American Artisan*, pp 79-84, May, 1947.

TABLE 1.—DATA ON COMMON PAINT SOLVENTS AND DILUENTS

Solvents and Diluents	M.W., Gr.	Sp.Gr.	MAC* Ppm	LEL** %	Dilution rate in cu ft per pint from standpoint of	
					Health	Explosion
Acetone	58	0.79	500	2.1	11,500	265
Amyl acetate	130	0.87	200	1.1	13,500	250
Amyl alcohol	88	0.82	100	1.2	39,000	320
Benzol (benzene)	78	0.88	50	1.4	94,000	330
Butyl acetate	116	0.88	200	1.7	15,000	180
Butyl alcohol	74	0.81	50	1.7	91,000	265
Butyl cellosolve	118	0.90	200	....	16,000	....
Cellosolve	90	0.93	200	2.6	21,500	165
Cellosolve acetate	132	0.97	100	1.7	30,500	180
Cyclohexanol	100	0.96	100	....	40,000	....
Cyclohexanone	98	0.95	100	....	40,000	....
Dioxane	88	1.04	100	....	50,000	....
Ethyl acetate	88	0.90	400	2.2	10,500	190
Ethyl alcohol	46	0.79	1000	3.3	7,000	210
Isopropyl acetate	102	0.87	200	2.0	17,500	175
Isopropyl alcohol	60	0.79	400	2.5	14,000	215
Methyl acetate	74	0.96	200	4.1	27,000	130
Methyl alcohol	34	0.80	200	6.0	51,500	160
Methyl cellosolve	76	0.97	25	....	210,000	....
Methyl ethyl ketone	72	0.81	200	1.8	23,000	255
Methyl isobutyl ketone	100	0.80	100	....	33,000	....
Petroleum ether	72	0.63	500	1.4	7,200	255
Propyl acetate	110	0.75	200	2.0	14,000	140
Stoddard solvent	130	0.80	500	1.1	5,000	240
Toluol (toluene)	92	0.87	200	1.3	19,500	300
Turpentine	136	0.87	100	0.8	26,000	325
VM & P naphtha	110	0.75	500	1.2	5,600	235
Xylol (xylene)	106	0.88	200	1.0	17,000	340

*Approximate maximum allowable concentration in parts of substance per million parts of air by volume.
**Lower explosive limit in per cent by volume.

From these data and the booth ventilation rate (usually about 150 cfm per square foot of face opening) the R in equation 1 may be derived easily, and then the maximum permissible percentage of recirculation may be calculated. Table 2 contains data on this point for a few values of R.

Let us consider an example. What is the maximum permissible percentage of recirculation from a $6 \times 6\frac{1}{2}$ ft booth in which spray painting is carried out with a paint the liquid component of which is amyl acetate. The average paint consumption rate is one quart every three minutes.

From Table 1 the dilution rate for amyl acetate from the health standpoint is 13,500 cu ft per pint or 9,000 cfm for the one quart paint used every three minutes. The booth ventilation rate should be known or measured in practice, and for the purpose of this example we will assume it is 150 cfm per sq ft of face opening, or $150 \times 6 \times 6.5 = 5{,}850$ cfm. From these two values R in equation 1 equals 1.54 and $P = 39\%$ (See also Table 2).

To get a clear mental picture of what takes place at a spray painting operation as described, let us analyze the situation created by this operation. For this purpose it will be necessary to consider the air-flow rate and the vapor concentration at three points, namely, in the discharge stack, in the recirculation duct, and at the entrance to the booth. With a recirculation rate of 39%, 61% of the air passing through the booth, 3,570 cfm, will be discharged to the outside. Obviously, when conditions have attained equilibrium, the vapor will be carried away as fast as it is produced; that is, the 0.67 pint per minute will be carried away in 3,570 cfm of air. The concentration of vapor in the discharge air will then be 515 ppm from equation 2.

The recirculated air, 2,280 cfm, obviously contains the same concentration of vapor. Since it is mixed with 3,500 cfm of uncontaminated make-up air from the room or from a specific outside supply, the resulting concentration of vapor in the air entering the booth (assuming that the recirculated air and the make-up

(Continued on page 116)

TABLE 2.—MAXIMUM PERCENTAGE OF RECIRCULATION PERMISSIBLE

Dilution Rate* / Booth Ventilation Rate (R)	Maximum Per Cent of Recirculation Permissible
3	25
2	33
1.5	40
1	50
0.75	57
0.50	67
0.25	80

*Dilution rate in cfm from Table 1 or equation 2.

Experience is my Classroom

By T. W. REYNOLDS

EDITOR'S NOTE. Mr. Reynolds continues the subject of servicing, trouble jobs, maintenance and similar problems.

Finned Radiation

Exposed finned type steam radiation is always terminated on the return end with an eccentric fitting, or a reducing ell looking down, for drainage. However, if the medium used for heating is hot water it may be that some will use a non-eccentric reducer. This leaves water in about half the diameter of the pipe which, even if frozen, may do no damage. On the other hand, the pocket so formed does tend to collect sediment, particularly on new construction. The pocket also adds to corrosion during the non-heating season, since the retained water is in contact with air.

Physical or thermal conditions may sometimes require more than three tiers high of finned radiation, but three tiers high is the point where additional tiers make the combination uneconomical, due to loss in thermal efficiency. Tiers must not be on less than 6-inch centers with 2-inch tubes, otherwise the second tier cannot be screwed on when assembled on the floor. The diagonal of the square fins must clear as they are turned unless the second tier is assembled for fins to offset those of the first tier. In any event, regardless of physical assembly, 6-inch centers are required for best thermal efficiency.

Tiers may be assembled for flow in series by using return bends furnished by the manufacturer welded or by the contractor, and assembled on the job. This practice is often resorted to and with negligible drop in temperature of the hot water flow, even if tiers are four or more high. Where connecting headers are used, each tier need not be separately valved to equalize flow through the tiers, as I have seen done.

Oil Burners

The oil burner does not run. Looking over the situation, one finds that the low water cut-out is stopping the burner, as it should, because of low water in the boiler, yet strangely enough the water line is apparently high in the gage glass. This is soon explained, for both gage cocks are found closed. In other cases, the low water cut-out is stopping the burner on the dip of a wave in a foaming boiler. It's funny, some owner says, but my oil burner does not run; actually, it is not funny at all, for the oil tank is empty. Or else, on other occasions, he may find that it is nothing but a dirty strainer that is the cause of all his trouble.

(The question of servicing will be continued in this department in a subsequent issue.)

• ENGINEERS ARE TOO FREE WITH ADVICE

Commuting groups on railroads are apt to be made up of men quite diverse in their pursuits. There may be a group comprising a business man, a lawyer and an engineer. The lawyer and business man are always having trouble with their heating systems, or know some fellow who has a friend who has trouble of this kind. So the engineer freely expounds on the subject, because parts of it he considers of fairly common knowledge or of no great value, or he does it to (1) make the conversation center around himself, (2) to appear learned, or (3) just to be gracious.

Eventually, some day or other, a legal point of minor nature gets interjected into the conversation by the engineer or the layman. Immediately, the lawyer gets out of the conversation and reads the newspaper he had momentarily laid aside when the subject was the heating system in his own home. He is skilled in avoiding comment, changing the subject, and leaving to visit with some other commuter. He knows everyone thinks he is learned, and that the more he keeps silent, the more they think he knows.

You can hunt and fish with a lawyer for years, and he may make a mighty good companion. Let the conversation get away from fish or pheasants to some legal point which comes up only as a matter of curiosity and he will either turn over and go to sleep by the fire, or ask you how much stone you think it will take to build a stone wall on his property. If you are wise, and know anything about stone walls, you tell him he should accumulate more stones than he thinks he needs, and even more stones than you think he needs. Thereby, you have spoken the truth, yet avoided the issue, much the same as a lawyer would.

As a rule, though, you are kind and stop around to his home some night and remedy his heating difficulties "for free." However, when a legal matter comes up, you turn it over to him and pay him for it. After all, he is your friend. After that he is not, because he always finds more work attached to your problem than he had anticipated and makes some comment that he is sorry he ever got entangled with your problem. He has the same hang-dog air that some contractors get as soon as they are awarded a contract.

The lawyer has a corner on his kind of knowledge; his profession, as a whole, cooperates in keeping mum on legal matters. Engineering, however, is not as closed a proposition. The lawyer never defends his opinions, but an engineer has to with everyone with whom he does business.

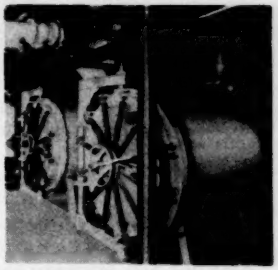
PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

Conducted by WM. B. FOXHALL, Associate Editor

Filtration of Hot Water Removes Oil

PROBLEM: At the Hershey, Pa. plant of Hershey Chocolate Corp., extensive use is made of hot water at closely controlled temperatures in the manufacturing of chocolate products. Tubular steel boilers are used for water heating purposes. Water is pumped through the process and heating systems is returned to the boilers through filters. All traces of oil must be removed from the water to prevent hot spots on boiler tubes and process equipment. Formerly, an alum flocculation type filter was used, but slight deviations in pH caused the floc to break, allowing oil from circulation pumps to pass into the filtered water.



SOLUTION: A new filter installation includes two Type 40 leaf filters, manufactured by Hercules Filter Corp. Each filter has 306 square feet of fiber filter screen area. Diatomaceous earth is mixed with a portion of water and pumped through the filter screens. The water is recirculated until the material is deposited on the screens and the effluent filtrate is running clear. With the bed thus formed, actual filtration is begun.

RESULTS: Clear, oil-free filtrate is obtained. From time to time, diatomaceous earth is added to the unfiltered liquid to recondition the filter bed built up on the preformed fibrous filter layers.

Wide Temperature Range Aids Meat Storage

PROBLEM: At the American Meat Institute Foundation, Campus of the University of Chicago, temperatures from 32F to —40F were required in four separate refrigerators covering ranges as follows: (1) —40F to —20F; (2) —20F to 0F; (3) —10 F to 10F; and (4) 10F to 32F.

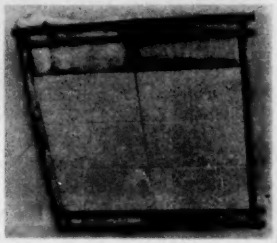
SOLUTION: The Thermobank, manufactured by the Kramer-Trenton Co., was used in all four refrigerators. The installation was made by Refrigeration Systems, Inc. of Chicago.

RESULTS: Temperatures in various rooms are adjustable and controlled by thermostats. Completely satisfactory performance of the system is reported.

Radiant Heating and Cooling Ceiling Developed

PROBLEM: In the new building of the Architectural Products Division of the Burgess-Manning Co., Chicago, a demonstration installation of the company's new radiant heating and cooling ceiling, with acoustical treatment, was to be installed.

SOLUTION: The Burgess-Manning ceiling was made up of perforated aluminum acoustic panels mounted on a framework of pipe and angle irons and backed by sound absorbing materials. Pipes attached to the backs of the aluminum panels are supplied with warm water in winter and cold water in summer. Piping and framework units of the ceiling are suspended from rafters or from a conventional ceiling, and the perforated metal panels snapped in.



RESULTS: An attractive acoustic ceiling combines the functions of heating and cooling. Use of lightweight materials avoids lag characteristics of heavier panel heating installations. Perforated metal panels can be removed for inspection of the system. Multi-Vent air distribution panels and All-Bright light troffers fit into the ceiling design with modular dimensions.

Low Temperature Drying Protects Instruments

PROBLEM: In aircraft instruments subjected to the low temperatures of high altitude, precipitation or snowing of moisture in the gases enclosed within the instrument is a serious problem.

SOLUTION: Lear Inc., Grand Rapids manufacturer of aircraft and radio accessories, uses a sub-zero industrial chilling machine which pre-cools to —130F the gases used to fill instrument cases. Coils of copper tubing are installed in the chilling machine. Hydrogen and helium are forced through this tubing and quickly chilled. The water vapor in the gas condenses out in the form of ice crystals. The condensate is trapped by filters before it can enter the supply line. The gases are warmed to room temperature before being used to cool the instruments. The chilling machine is manufactured by Sub-Zero Products Division, Deep Freeze Distributing Corp., Cincinnati, Ohio.

RESULTS: Practically all moisture is removed, even to the extent of the minute quantity found in and on the metal being used. Condensation in instruments at high altitudes with consequent inaccuracy or inoperation, is prevented.

Packaged Unit Serves Central System

PROBLEM: The interior of the Traub Drug Store in Hamilton, Ohio, is long and narrow with merchandise counters along one side and a tobacco department and soda fountain on the other. The rear of the store contains the prescription room. A glass show window across the front faces the south. The owner did not want to use valuable floor space by locating an air conditioner in the merchandising area. The only other spot was in the enclosed area in the prescription room. Location at the rear of the store would require the cooled air to travel a considerable distance to reach the front section of the store.

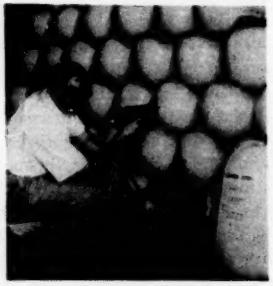
SOLUTION: A self-contained 3-hp Frigidaire unit was installed in the prescription room. An air distribution duct more than 50 ft long was constructed leading from the air conditioner along the side of the merchandising area. The bottom of the duct forms the top of a series of wall shelves. The duct has distribution grilles spaced at 10-ft intervals. The conventional 4-way hood from the unit was removed and the duct connected directly to the fan chamber of the unit.

RESULTS: The self-contained unit performs the functions of a small central system. Store patrons come in more frequently and stay to shop for longer periods during the summer.

Leak Detector Protects Oxygen for Airmen

PROBLEM: One of the requirements for high altitude flying is the maintenance of adequate uncontaminated oxygen supply. Oxygen is furnished in steel tanks and bottles and must be dry and free from contaminating gases.

SOLUTION: The Zep Aero Co., which repairs, reconditions, processes and refills oxygen tanks and bottles for use on military aircraft, is using a General Electric Type H leak detector to search for contaminating halogen vapors, such as chlorine, which may get into oxygen tanks and regulators. The leak detector is equipped with a long, thin probe which is inserted into the oxygen cylinder and is capable of detecting minute traces of halogens. Cylinders which show traces of contaminating halogens are rejected and purged.



RESULTS: Aviators are assured of a supply of breathing oxygen free from contamination.

Direct Expansion Units Save Water

PROBLEM: In a new low temperature warehouse for the frozen food division of the Peoples Ice Delivery Company, Muncie, Ind. George Ludington, chief engineer, specified automatic refrigeration without the use of water. The warehouse was to be capable of processing a carload of frozen food products each day and a 50- by 40-foot area with a 9-foot ceiling was to be maintained at a constant temperature of —5F with automatic defrost.

SOLUTION: The equipment selected was a series of Kramer Unicon air cooled condensers with the Thermobank automatic defrost system. The 20-hp low temperature installation was divided into four separate 5-hp systems, each pipe separate. Service on any one will not affect the operation of the other three systems.

RESULTS: A waterless, 20-hp cooling system is set up so that it can be serviced without danger of any rise in space temperature. Each coil can be automatically defrosted in six minutes. Low space temperatures are maintained and sewerage charges for the runoff of cooling water are eliminated.

Scaffold Heated for Winter Construction

PROBLEM: The summer and fall of 1948 were not long enough to complete the entire building program at the Lincoln Building in Portland, Oregon. Plans called for facing the outside walls with ceramic veneer, but cold weather intervened before the project was completed.

SOLUTION: The Contractors rigged up a special covered scaffold. On the outside rail of the scaffold they ran piping on which they installed several Trane convectors. The piping system was connected by flexible hose to a steam supply and return within the building. To complete the facing job, the scaffolding was swung into place in the evening and the heat turned on. During the night heat from the convectors was applied to the area to be faced.

RESULTS: By morning the surface was warmed and dry, ready for masonry work. After the ceramic veneer was applied the heat was left on every night to prevent the mortar from freezing. With this operation completed, the scaffolding was moved up another 7 feet and the process repeated. The contractors were able to complete the job in spite of the freezing weather.

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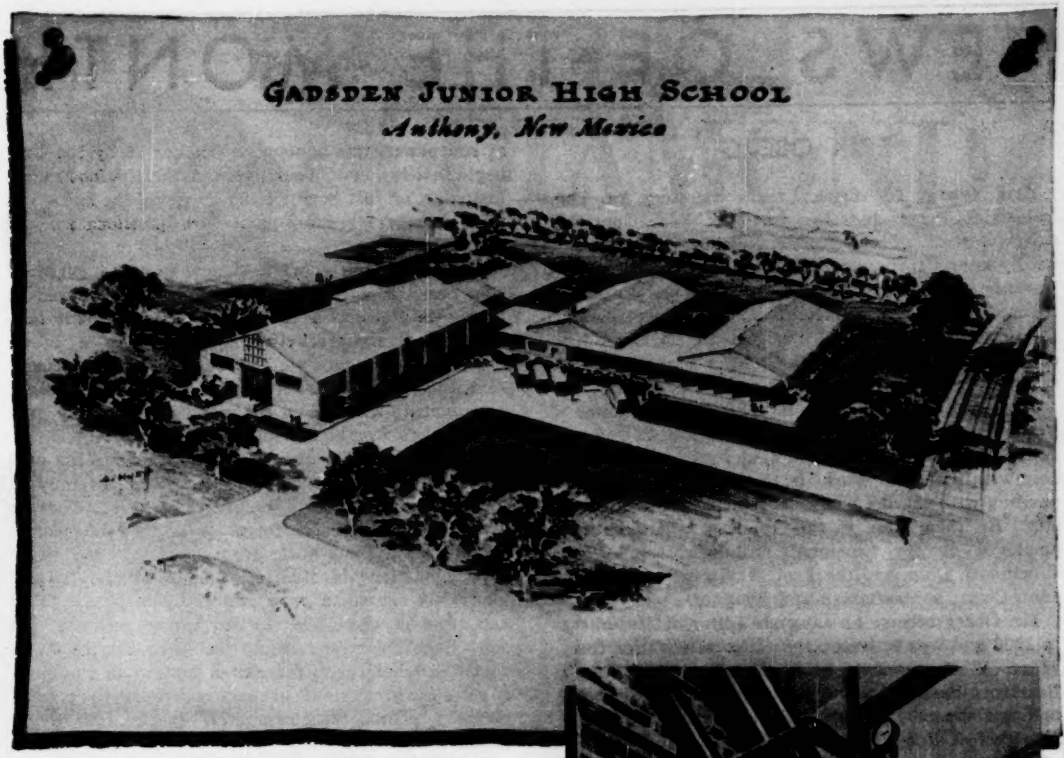
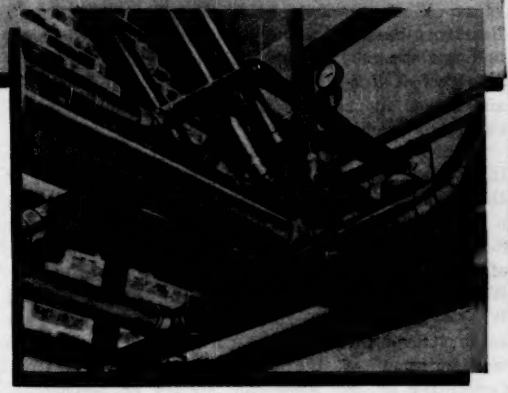
H&V will pay on publication. Send to Editor, Heating and Ventilating, 148 Lafayette Street, New York 13, N. Y.





ANOTHER CASE OF

COPPER

where it counts!

● Although the newest, most modern design and construction techniques are used to create buildings like the Gadsden Junior High School, it's the materials that have been tested and proved over the years that are entrusted with the important jobs.

That's why 13,000 feet of Revere Copper Water Tube were used for the hot and cold water lines . . . in the heating system . . . and as vent stacks in the Gadsden Junior High. Centuries of use have proved copper endures. Revere Copper Water Tube is non-rusting and comes in straight lengths of 12′ and 20′ as well as 60′ coils to suit every type of installation. The longer length can be bent to save fittings. The solder or compression fittings used with Revere Copper Water Tube make it possible to use a thinner wall tube than when threaded fittings are used, resulting in a substantial saving in metal and easier workability in inaccessible places.

Supplies of Revere Copper Water Tube may necessarily be limited, but, remember: you can still use it for underground service lines, domestic hot and cold water lines, industrial processing and for gas equipment. See your Revere Distributor. He will advise you of the availability of materials and, if you wish to discuss technical problems, will put you in touch with Revere's Technical Advisory Service.

"WE ARE PROUD OF the amount of building we procured for the price," said Mr. Rex F. Bell, Superintendent, Gadsden Independent Schools, when he inspected the newly-completed Junior High at Anthony, New Mexico. Architect—Truman J. Mathews, Santa Fe, N. M.; Consulting Engineers—Davis & Foster, El Paso, Texas; General Contractor—Gilchrist Const. Co.; Plumbing Contractor—Ruiz Plumbing Co., Inc., both of Las Cruces, N. M.; Distributor—Momsen Dunnegan Ryan Co., El Paso, Texas.

(insert photo) IDEAL FOR TIGHT SPOTS LIKE THIS—Revere Copper Water Tube takes up less space than bulky, threaded pipe and the fittings used do not require a lot of room for swinging a wrench. Tube sizes used range from ½" to 3" in diameter.

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NEWS OF THE MONTH

ERIK OBERG

Erik Oberg, for fifteen years secretary of The Industrial Press and for forty-six years on the editorial staff of the technical journal *Machinery*, widely known throughout the machine tool and metal-working industries of America and Europe, was killed by an automobile in Rockford, Ill., on October 22. Mr. Oberg had just completed a call on the Rockford Machine Tool Co. and was struck by a speeding automobile as he returned to his car.

Born in Veramo, Sweden, in 1881, Mr. Oberg was a graduate of the Government's Technical College of Boras, Sweden. Upon concluding a term of apprenticeship with the Atlas Works in Stockholm, he secured a position with the Bolinders' Mechanica Works of that city. He then came to this country, where he was employed by the Cincinnati Milling Machine Co., Cincinnati, Ohio, and the Pratt & Whitney Co., Hartford, Conn., as draftsman and designer.

Mr. Oberg became an associate editor of *Machinery* in 1906 and was active on the editorial staff for forty years. While associate editor he edited *Machinery's* Reference Series, wrote a number of technical books, and was the co-author of *Machinery's Handbook* and *Machinery's Encyclopedia*. He became editor in 1918 and served in that capacity until 1946 when he resigned to become consulting editor.

While editor, Mr. Oberg won distinction in engineering circles, having served for ten years as treasurer of the American Society of Mechanical Engineers and as a member of various important committees of that Society. In the first World War he was a member of the Committee for Adjusting the Industries to War Work appointed by the Government. During World War II, he served a period with the War Department as consultant to the Army Air Forces. He was also vice-chairman of the Manufacturing Engineering Committee of the American Society of Mechanical Engineers, working under the auspices of the War Production Board.

Mr. Oberg is survived by his widow, Mrs. Helena E. Oberg; a son, Henry V. Oberg, of Cleveland, Ohio; and a stepson, Wilbert A. Mitchell, of Springfield, Vt.

Mr. Oberg was greatly admired by all who knew him for his high integrity, great industry, strong personality, and extensive engineering knowledge. He will be deeply missed by all of his associates in The Industrial Press and his many friends throughout industry.

SUN POWER

from large-scale culture of algae nearer as pilot plant reports success.

The first large-scale production of what may be a new source of food and energy, developed with the help of sun power, was announced October 15 by the Carnegie Institution of Washington. What the food might taste like, or just how it could be used—the basis is a tiny green fresh-water plant—are questions for the future.

• **NEXT STEP.**—The work is now in the pilot plant stage, and the institution said the next step would be to determine whether the process is feasible for full-scale commercial production.

If it should prove so, the Carnegie announcement said, the substance involved and others like it might represent an increase in the world's food supply or a source of fuel or industrial raw materials.

• **GROWTH.** — The material under study is the one-celled green alga plant, chlorella, one of a family of plants which, in nature, occur either as seaweeds or as various microscopic forms of fresh-water plants. Chlorella is a fresh-water form.

In the Carnegie studies, samples of the natural plants are caused to grow artificially in plastic tubes and troughs which are exposed to the action of the sun. Such chlorella farming has been carried on in scientific laboratories for half a century in the quest to solve the great riddle of photosynthesis—the process whereby plants transform solar energy into living tissue or food.

But Carnegie officials told a reporter they believe theirs is the first large-scale production of chlorella by use of solar energy.

• **EFFICIENCY.** — Officials offered no details on the efficiency of the process, but scientists long have contended that it is theoretically possible to utilize as much as 80% of the sun's radiant energy in the laboratory development of chlorella. In contrast, any plant growing in its natural environment makes use of only about 1% of the energy available from the sun.

The Carnegie Institution disclosed that during the last six months a chlorella-producing pilot plant with a total growing area of 1,200 sq ft utilizing solar energy has been placed in operation at the facilities of Arthur D. Little, Inc., consulting research and development organization of Cambridge, Mass.

Continuous growth has been maintained and material harvested daily, said Carnegie's announcement. During the next phase of the project, emphasis will be placed on obtaining estimates of the cost of a full-scale installation and on finding out whether the product is satisfactory for various purposes.

The environmental factors that affect the growth rate of chlorella are being studied by several members of the staff of the institution's department of plant biology at Palo Alto, California, and by Professor J. E. Myers, University of Texas, who is supported as a fellow of the institution. A separate phase of the program is being carried out by Dr. R. W. Krauss, University of Maryland, another fellow of the institution, who is culturing a large variety of different species of algae.

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SAVE FUEL
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INCREASE BOILER CAPACITY

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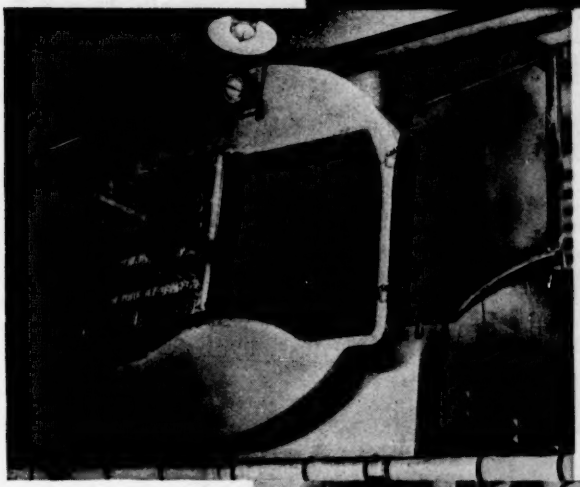
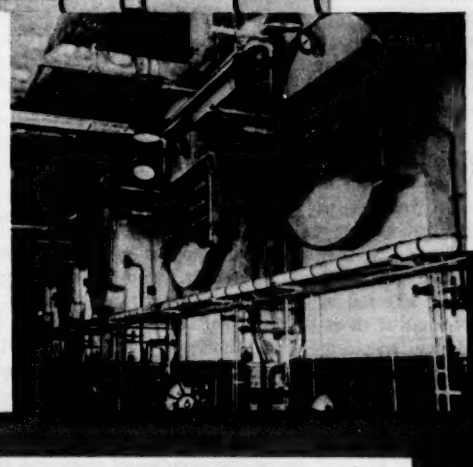


Accumulated soot in a boiler is a tremendous waster of fuel. Soot is an exceptional insulator . . . a very effective barrier to the heat. Cold rooms, higher fuel bills, general unsatisfactory operation are the result. Hand cleaning is inefficient, dirty, even dangerous.

Diamond A1E Automatic "Air Puff" Soot Blowers do a really efficient job of cleaning, without trouble, dirt, or nuisance. The boiler does not need to be taken off the line. The operator merely pushes a button and turns a valve . . . operation is automatic.

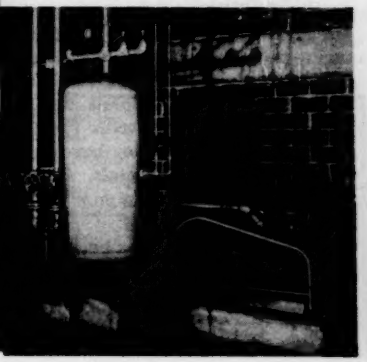
The Diamond "Air Puff" system is practically foolproof and is applicable to any number of boilers. For better heating, fuel saving, and a cleaner boiler room, investigate Diamond A1E Automatic "Air Puff" Soot Blowers. Write for Bulletin 897-P.

▲ *Multi-Nozzle Element of A1E blower automatically rotates in a series of steps, blowing the entire tube bank. Cleaning is efficient—complete*



◀ *Five fire tube heating boilers at large housing project are cleaned with Diamond Automatic "Air Puff" Soot Blowers.*

▼ *Small compressor and receiver supply all compressed air needed for battery of boilers shown at left.*



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CONSERVATION ORDER

for air conditioning and refrigeration industries proposed by NPA would save by standardization.

A proposed simplification and standardization order to conserve critical metals in the commercial and industrial refrigeration and air conditioning industry was discussed at a September meeting of the manufacturers' industry advisory committee and the National Production Authority, U. S. Department of Commerce.

The order would prohibit production of equipment not conforming to certain sizes, types, grades, finishes, and other specifications.

The draft was prepared by NPA in consultation with different segments of the industry. Setting up of specifications for the proposed conservation order was begun in April.

• **NOT NOW.**—NPA pointed out that limitation orders to conserve critical metals by simplifying or standardizing production are not being issued now unless there is complete acceptance by the industry concerned, and unless a very substantial savings in materials will be made.

NPA said the proposed order will not be issued now. The committee agreed that there is no need for the order at this time. Members stated, however, that the draft provides "excellent groundwork" should an urgent need arise for a conservation order on the industry.

In a discussion of the proposed order, NPA said that even if issued, the order would not assure the allotment of more materials to the refrigeration and air conditioning manufacturers, but it would permit them to produce more of certain types of units with the available materials.

• **METALS.**—In a review of the metals situation, NPA reported that:

(1) Steel sheet and strip supplies should be heavier in the first quarter of 1952. But galvanized sheet will remain severely low because of the zinc shortage.

(2) The scarcity of copper will continue for at least four more years. There is ample productive capacity, but copper ore and scrap are seriously short.

(3) Aluminum supplies will be reduced in the fourth quarter and the first quarter of 1952 because of the hydroelectric power shortage in the Pacific Northwest. Production will increase within two years, with the development of additional power sources and productive facilities.

The refrigeration and air conditioning manufacturers said their industry will be seriously affected by the new cut in aluminum production. Because of shortages in copper and stainless steel, and new specifications by the Armed Forces for their products, committee members said they have substituted aluminum liberally for scarcer metals. One manufacturer said his substitution of aluminum accounted for 40% of the copper formerly used.

• **ALREADY SAVING.** — Committee members stressed the definite move for conservation in their industry. Members reported that they produce many units that are competitive within the industry. As a cost factor, they already use minimum quantities of materials, it was pointed out. Anticipating critical shortages, several manufacturers said they have made considerable investments on new tools and dies for the use of alternate materials.

One manufacturer said his company's backlog is now one-third of what it was in February. He said 58% of his fourth-quarter orders are defense-rated and that his CMP allotments are insufficient to fill non-rated business. He contended that much of the non-rated business is as vital to the defense mobilization effort as the rated business.

Other manufacturers also stated that their DO-rating patterns are not necessarily indicative of the essentiality of their customers' operations.

A. Gordon Wooton, of NPA's General Industrial Equipment Division, presided.

• **MEMBERS.**—These committee members attended:

Alwin B. Newton, Acme Industries, Jackson, Mich.
M. Nobel, Aerofin Corp., Syracuse, N. Y.
A. Zumbrun, Brunner Manufacturing Co., Utica, N. Y.
E. M. Flannery, The Bush Manufacturing Co., West Hartford, Conn.
A. P. Shanklin, Carrier Corp., Syracuse, N. Y.
W. H. Aubrey, Frick Co., Inc., Waynesboro, Pa.
Frank Faust, Air Conditioning Division, General Electric Co., Bloomfield, N. J.
William B. McMillan, Hussman Refrigerator Co., St. Louis, Mo.
E. C. Marsden, Marsden & Wasserman, Inc., Hartford, Conn.
H. T. Jarvis, Refrigeration Engineering Inc., Los Angeles, Calif.
George S. Jones, Jr., Servel Inc., Evansville, Ind.
John H. Coolidge, Sherer-Gillett Co., Marshall, Mich.
Orville C. Morrison, Sunroc Refrigeration Co., Glen Riddel, Pa.
W. A. Siegfried, Superior Valve & Fittings Co., Pittsburgh, Pa.
Tom Pendergast, Universal Cooler Division, Tecumseh Products Co., Inc., Marion, Ohio.
H. F. Hildreath, Refrigeration Specialties Dept., Westinghouse Electric Corp., Springfield, Mass.
M. G. Munce, York Corp, York, Pa.

FINNED TUBE

to be in short supply, NPA tells committee at extended surface heating equipment meeting.

A proposed order aimed at conservation of critical materials was discussed September 28 by the Extended Surface Heating Equipment Industry Advisory Committee at a meeting with the National Production Authority, U. S. Department of Commerce. The proposed order would limit copper tubing for blast coils to certain nominal lengths. In addition, casings, enclosures and parts would not contain any metal other than iron and steel, except for small fittings. Reduction of the number of sizes and types now being produced in the industry would also result in the production of more units of equipment to maintain continuous operation in view of the tight materials situation, NPA said.

Industry spokesmen said their allotments of copper

It's simple to make a good flared joint connection

1 Unroll the coil of Chase Soft Temper Copper Water Tube. Cut off needed length with hacksaw.

2 With a file or a reamer, remove all of the burs and smooth the inside edge of the tube at the opening.

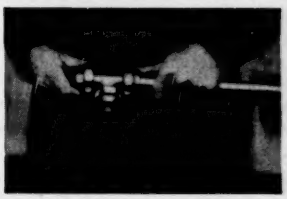
3 File off the burs and smooth the outside edge. Filing and smoothing make a snug fit at the fitting.

4 Slip the sleeve nut over the end of the tube. Be sure threads are toward the open end of tube.

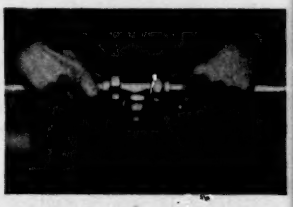
5 Choose a flanging tool corresponding to the size of tube. Cover tool shank with oil and insert into tube.

6 Hammer the end of the flanging tool until the edge of the tube fits into the undercut of the tool.

7 After flanging, draw sleeve nut to end of tube. It is now ready to be threaded onto the fitting.



8 Put a drop of oil on the inside surface of the flange. Insert fitting into the sleeve nut and tighten it well.



9 Fit the next tube in the same way. Screw up the sleeve nut tightly so as to make a strong connection.

THE EASE of making flared joints is only one of the many advantages of Chase Copper Water Tube.

CHASE TUBE is *soft tempered* . . . easy to bend around corners or form into U-bends. You'll appreciate this Chase feature in laying underground water lines and oil lines.

CHASE COPPER WATER TUBE is excellent for replacement work, too. It comes in long lengths up to 100 ft. that can be snaked between partitions and under floors, with a minimum of disturbance to existing construction.

FREE folders give details on making flared joints and solder-joint connections with Chase Copper Water Tube.

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and aluminum for the fourth quarter of 1951 were inadequate to meet their defense orders.

• **SUPPLY.**—The committee said the industry's fourth quarter allotment of steel was approximately 50% of its requirements; that it had been able to place only 80% of this allotment with mills for delivery; and that it had received only 30% of its copper and aluminum requirements for the fourth quarter.

One industry spokesman said his company has a backlog of three months' accumulated orders going into the fourth quarter. With the allotments of steel, copper and aluminum granted his firm, it could hope to fill about 40% of these backlogged orders and give no consideration to new orders received, he said.

• **ESSENTIAL.**—Approximately 90% of the unit heaters produced go into essential construction such as schools, health and public facilities and factory buildings for defense production, the committee said.

The committee reported that it was unable in several cases to get mills to accept orders for delivery of critical materials. NPA said it would help such companies to place their orders.

ASRE PROGRAM

to feature technical sessions and concurrent discussions of problems in refrigeration.

Expanding a procedure adopted a few years ago of having a concurrent conference and informal discussions on a specific subject, the program committee of ASRE has decided on four such conferences, some of which will run concurrently with the regular technical sessions at the annual meeting to be held at Hotel Roosevelt, New Orleans, Dec. 2-5. These conferences are for the discussion of (a) low temperatures (b) domestic refrigerator engineering problems (c) industrial insulation applications, and (d) packaged air conditioners.

• **LOW TEMPERATURE.**—Among the subjects to be discussed at the low temperature symposium are: Freon and oil relationship in low temperature refrigeration; a description of the laboratory of cryogenic engineering at Massachusetts Institute of Technology; design and construction problems of air separation plants; low temperature application in the field of lyophilization; moisture removal from a —85F methylene chloride refrigeration system.

• **DOMESTIC.**—The domestic refrigeration engineering conference, the forerunner of this more informal type of meeting, will not schedule any formal papers but will present a discussion of alternate materials, a subject of prime importance in the present emergency, when the production of basic materials is restricted. Qualified representatives from suppliers of basic materials as steel, copper, aluminum, and chemicals used as refrigerants will present their views on the outlook for both the present and the future of the use of these materials in the refrigeration industry. The meeting will then be thrown open for a full discussion of this subject.

• **INSULATION.**—Following the same pattern will be the conference on industrial insulation applications

A unit heater for every need

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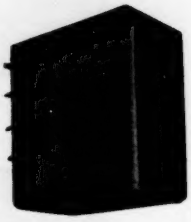
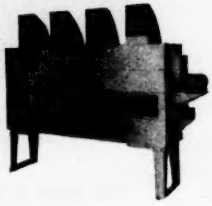
HERMAN NELSON

Vertical shaft propeller-fan type unit heater—*especially suited to buildings with high ceilings—up to 50 feet.*

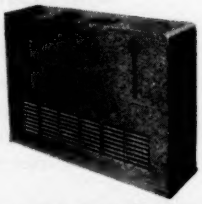
Horizontal shaft propeller-fan type unit heater—*the most generally useful of all space heaters.*



Centrifugal-fan type unit heater—*for efficient heating and ventilating of large industrial spaces.*



De Luxe unit heater—*an attractive, quiet operating unit designed for stores, offices, churches, etc.*



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Division of **AMERICAN AIR FILTER COMPANY, INC.**

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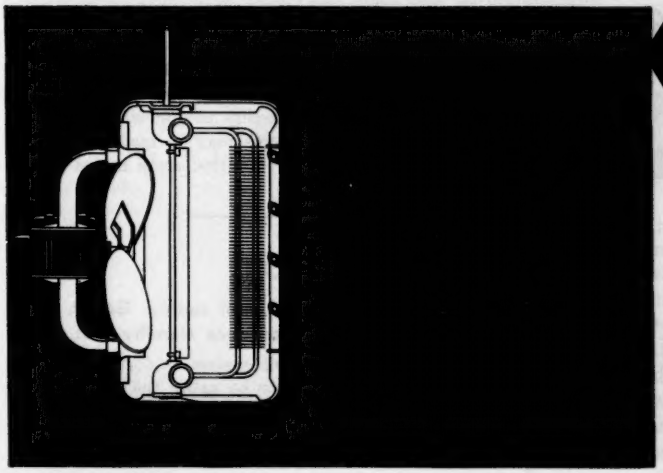
Here is the economical, efficient solution to the heating problems of most commercial and industrial establishments. There are 18 sizes of Herman Nelson horizontal unit heaters. B.T.U. output ranges from 25,000 to 350,000 per hour. All units operate on steam or hot water. Single or two speed motors are available in either 115 or 230 volts, AC or DC.

Herman Nelson unit heaters are ahead of the field because constant engineering development and research plus functional design have earned this position—the result of 45 years of experience in the production of heating and ventilating equipment.



SUPERIOR IN *BOTH* HEATING ELEMENT AND FAN DESIGN

Herman Nelson unit heaters are suitable for the smallest service station or the largest factory. Each size unit does an extremely efficient job of heat transfer and distribution. This is because *both* heating element and fan are unique in design. Study the 10 points listed on the left and you'll see that every part has been carefully engineered to do its particular job best. The result is a highly functional and efficient unit housed in attractive, sturdy, steel cabinet, easy to install — gives years of trouble-free dependable service.

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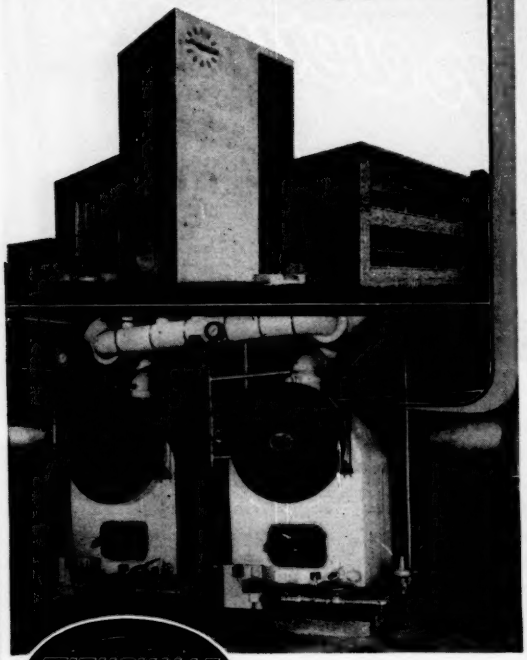
MOLINE, ILLINOIS

AT CARTHAGE, TEXAS

. . . a fine new school

. . . a fine heating plant!



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Compact

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HEATING BOILERS

The heating requirements of the new Carthage Junior and Senior High School are served effectively by these two Titusville Compact Steel Boilers. Rated (normal) at 17,000 square feet of steam radiation per hour—the modern gas-fired units occupy minimum boiler room space. Titusville manufactures a complete line of high and low pressure fire and watertube boilers to meet all capacity and pressure requirements. Our bulletin, "Meet the Titusville Family" sent on request.

THE TITUSVILLE IRON WORKS CO.

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Representatives in Principal Cities

where a panel of four or five engineers, well qualified in the application of insulation, will present brief "off the cuff" statements on specific applications, following which a discussion will be had on the points raised by the speakers and other topics pertinent to the question under discussion. Among those invited to sit on the panel are engineers from U. S. Air Force, cold storage warehouses, a bakery, an ice plant, and other industrial installations.

• **PACKAGED UNITS.** — The future of packaged air conditioning is the subject of the fourth conference. The topics to be discussed will be treated under the following headings: (a) room air conditioners; (b) self-contained air conditioners; (c) residential air conditioning. Each of these subjects will be discussed by a design engineer and a commercial application engineer giving their views on the future developments of these subjects. Following these presentations there will be a discussion of energy sources for packaged air conditioning by a prominent utility engineer. The usual period for discussion will afford an opportunity for any questions from those interested.

• **TECHNICAL SESSIONS.**—In addition to the conferences, the regular technical sessions will offer a wide variety of subjects of interest to the refrigeration engineer. Among those that have been scheduled are: Refrigeration and developments in farm milk operations, a discussion of bulk milk cooling and handling; specific heats of foods; fish freezing, by a Norwegian engineer; atomic radiation of food; refrigerator cars and their use; citrus fruits storage; measuring ultra rapid temperature changes; testing safety valves to comply with the ASA B-9 Safety Code; electric analogy of heat transfer; some unusual air conditioning installations; and, of particular interest to manufacturers and designers of air conditioning equipment, the calibrated room calorimeter test method. This device is specified by ASRE Standard 16-R for testing and rating room air conditioners and is the first information to be published on the subject.

The foregoing list of papers is somewhat tentative in that last minute changes may be made if, in the opinion of the program committee, such action seems advisable.

COAL CONVERSION

urged to fortify U. S. fuel supply. GAMA head proposes plants to produce standby fuel.

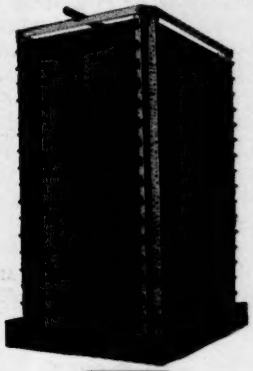
A great conversion-plant system to fortify and coordinate U. S. fuel supplies by using the nation's immense coal reserves to produce gas of uniform quality for peak-load requirements was proposed by Frederic O. Hess, retiring president of the Gas Appliance Manufacturers Association.

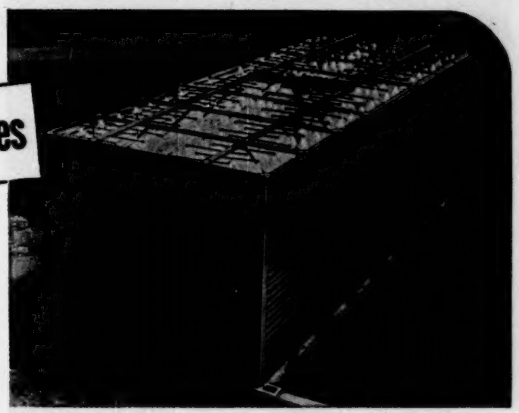
Speaking in St. Louis before more than 1,000 delegates to the 33rd annual convention of the American Gas Association, Mr. Hess challenged the gas industry to take advantage of the fact that we can make gas from coal, gasoline from coal, and oil from coal.

Mr. Hess, who is also president of the Selas Corporation of America, designers of heat processing

Binks NATURAL DRAFT COOLING TOWERS

30 standard sizes





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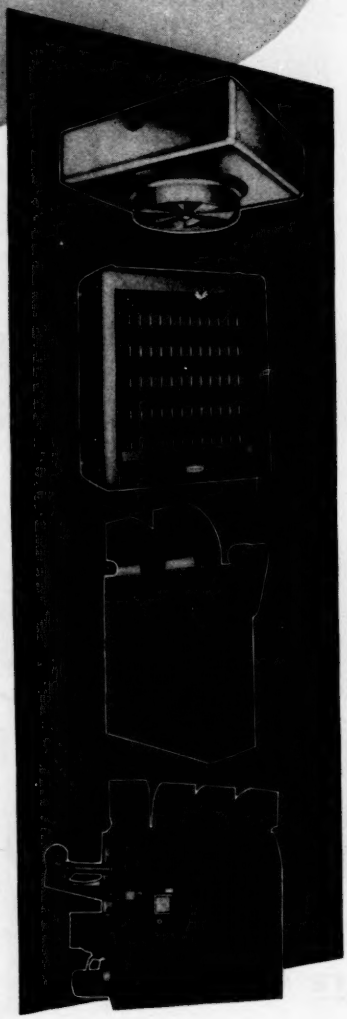

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equipment for heavy industry, warned his audience "we do not have enough natural gas or gas lines in the East and North to solve the problem of disproportionate summer and winter supply, of storage and even of the varying burning characteristics of the different types of gas now in use."

• **PROPOSAL.**—The solution could lie in a series of steps that would revolutionize the gas-distribution business and provide long-range benefits for both industrial and domestic gas users. These steps, he said, would be:

(1) Construction of large gas-conversion and standby plants at strategic points along the present natural-gas pipeline system and near our huge coal reserves. These plants would be designed to extract from coal a gas to be mixed with natural gas in order to augment supply, improve combustion performance, and produce a "really interchangeable standby gas" which would perform uniformly throughout a large area.

(2) Use of the conversion plants to provide storage capacity for the interchangeable standby gas. Such facilities would enable the industry to keep up with demand as natural gas supplies are taxed by winter weather.

(3) Use of excess plant capacity to produce gasoline from coal, especially during summer months when gas demand is comparatively low and gasoline requirements are high.

(4) Production of oil from coal—the product to be stored in concentrated raw form for winter-peak standby demands.

(5) Use of the conversion plants to make hundreds of valuable chemical materials which, when processed under controlled and mass-production conditons, would help defray the cost of the over-all operation.

While not committing other industries to his conversion plant program, Mr. Hess assured the Association that the coal industry is prepared to cooperate.

Mr. Hess conceded that the project he envisaged wou'd be costly, but argued that the cost would be negligible compared with the sums now required to build single pipelines from the gas fields to the gas markets.

• **SHORTAGE.**—At this time, he said, the gas industry is unable to meet the demands for gas heating in millions of projected new homes, despite the existence of 260 thousand miles of pipelines for natural gas alone.

In elaborating on his proposal that natural-gas pipelines be interconnected, Hess insisted that only such a move could assure constant service and uniform gas quality from Kansas City eastward to New England and down to Tennessee.

"True," he said, "this would involve physical problems and cost, investments and coordination, but progressive aims have never been stopped by such hurdles. Since the results would be beneficial to the public, the national welfare, industry in general, and the gas industry itself, even legislation should offer no obstacle.

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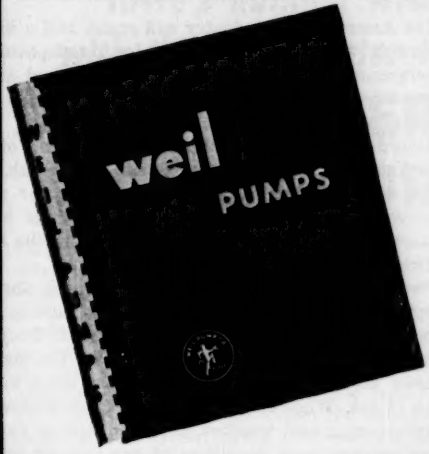

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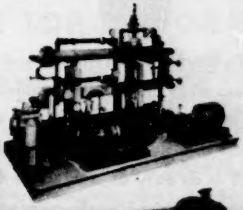

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to be pushed in 3-year program for handling winter loads and smoothing production costs.

The American gas industry will spend half a billion dollars in the next three years for development of underground gas storage fields, it was learned at the thirty-third annual convention of the American Gas Association in St. Louis.

According to Fenton H. Finn, vice president of the New York State Natural Gas Corp., Pittsburgh, one dollar of every five spent by gas utilities for plant improvement will go for underground savings banks to store natural gas near the big markets in the East, Midwest, and on the Pacific Coast.

• **OBJECTIVE.**—These fields make it possible for gas companies to meet peak winter demands, and to give better year-round service, Mr. Finn declared. They are usually old, depleted gas and oil fields. During the summer months they receive and store large inventories of gas. When customer demand for househeating mounts during cold weather, they can deliver rapidly out of storage huge quantities of gas to meet service peaks.

The A.G.A. estimates that about 350 billion cubic feet of natural gas is now stored in this manner, an amount equal to about one-fourth of the annual residential gas consumption in the entire United States. The savings bank system also keeps gas costs lower for consumers, since local utilities can buy the gas at a firm, year-round price, and conserve it until needed.

• **COMMITTEE.**—Costs of underground storage are very low, compared with those for above-ground tanks, additional storage pipelines, or stand-by gas-making plants used for emergency gas supply, Mr. Finn pointed out. He is chairman of A.G.A.'s newly formed Underground Storage Committee, which held its organizational meeting during the convention.

Searching for and rehabilitating gas storage fields is difficult, Mr. Finn declared, because certain underground geologic conditions are essential in order that the areas will hold the gas without losses, and will release it speedily when needed. There are now more than a hundred such fields in service, most of them having been developed in the last ten years.

The search for storage fields is so extensive that in some cases, potential reservoirs in deep limestone and sandstone formations, which have never held gas or oil, are being tested for their usefulness as storage areas, Mr. Finn stated. The new Underground Storage Committee of A.G.A. will compile storage records and disseminate information to the industry on the most advanced techniques of gas storage.

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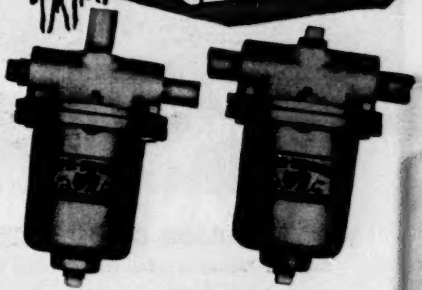

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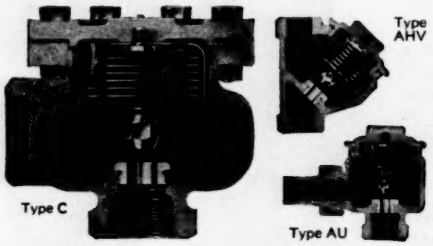

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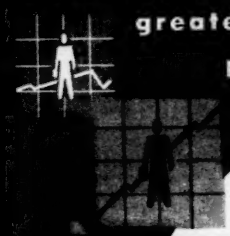

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house, according to an October 1 announcement by the president of the company, Rudolf Kuhlmann. The export firm would handle all arrangements, including the follow-up and checking of the operation.

• **ADVANTAGES.**—The licensing plan offers, Mr. Kuhlmann said, a number of advantages to American companies, including markets independent of U. S. business cycles, business without price controls, freedom from labor trouble, and independent of export licenses. The plan has most of the advantages and few of the disadvantages encountered in establishing branch factories or subsidiary companies abroad.

In its essence, a manufacturing license contract is simply an agreement for turning over technical knowledge to enable a foreign company to get started quickly and efficiently in making some product or line of products. But it goes further and provides for a continuing process of passing on information.

The manufacturing license method involves a minimum of financial risks for the American manufacturer, yet the income can be quite appreciable over a period of years, if the original agreement is properly drawn. Examples of foreign manufacturing license contracts entered into in recent years with considerable success include one for Australia by a leading American manufacturer of aircraft engines, one for Argentina by an outstanding American manufacturer of steel boilers, and another for Argentina by an electr'cal manufacturer.

• **ELEMENTS.**—In drawing up a foreign manufacturing license, three basic elements should be included. The first of these is the initial payment, a fixed sum of money given by the licensee to cover a substantial portion of the value of the first large transfer of information.

Second is the license fee usually figured as a percentage of the net sales, or sometimes as a percentage of the manufacturing cost. This is a contingent fee, dependent upon the volume of business done under the license. The percentage varies from as low as 2%, or even 1%, to as high as 10% or even 15%.

A third requirement is the minimum annual license fee, a fixed minimum yearly amount paid by the licensee when sales do not equal a stipulated value.

The manufacturing license contract is a highly specialized agreement, and experience has shown there are many ways of protecting each party, so that it will be a continuing mutually satisfactory relationship. It is in this phase of the operation, as well as in locating licensees, that Ameresco has a service to offer.

WHAT WOULD YOU DO?

(Continued from page 99)

air are piped to a point near the face of the booth) is $\left(\frac{515 \times 2{,}280}{5{,}850}\right)$ or 200 ppm does not exceed the safe limit for amyl acetate. The recirculation rate actually used should never be as high as the maximum permissible; a factor of safety should be employed in the calculations.

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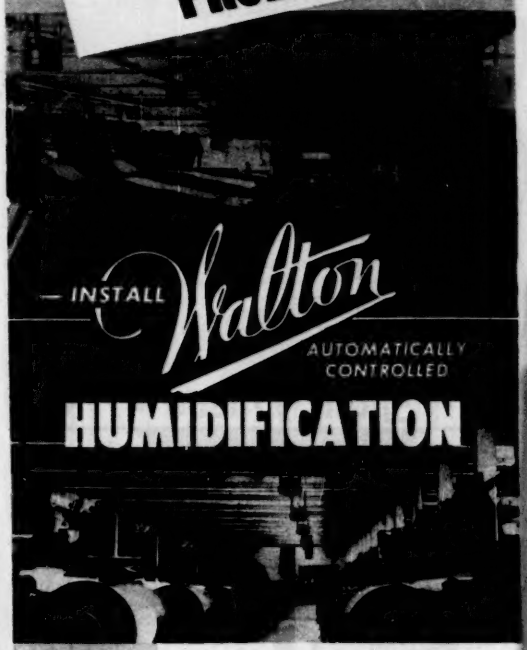

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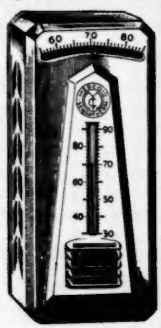

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In this analysis of the problem, the recirculated air was assumed to be returning to the paint booth. It is desirable in any scheme of recirculation that this be done unless the recirculated air can be fed to a well-ventilated area where adequate mixing of it with uncontaminated air is assured before it reaches the breathing zone of a worker. The reason for this is obvious. The recirculated air contained 515 ppm of the vapor, the safe limit of which is 200 ppm. It must be mixed with 2.6 times the recirculation rate of uncontaminated air to reduce it to a safe concentration. Even then, if the recirculated air is not piped to a point near the face of the booth, other workers may be exposed needlessly to the vapors of the painting operation, even though in harmless concentrations. By mixing the recirculated air with the make-up air and piping it to a point near the face of the booth, only the painter in the booth is exposed to the vapors, and, as shown, not to concentrations in excess of the maximum allowable concentration.

In the final analysis, air from a spray booth can be recirculated safely only so long as the concentration of the paint liquid vapor in the air of any exposed person does not exceed the maximum allowable concentration in question. Therefore, if some of the air is recirculated, the vapor concentration in the air of exposed persons should be measured by someone qualified to be certain that the safe limit is not exceeded. Even if the recirculation limit prescribed by the foregoing calculations is not exceeded, high concentrations may result if there is not thorough mixing of the recirculated air with the make-up air before reaching workers, or if the booth ventilation rate should fall off for any reason such as belt slippage, or if some of the discharged air is finding its way back into the building as make-up air.

In some instances, recirculation to conserve heat can be avoided by providing a positive supply of unheated make-up air and delivering it at the face of the booth; for example, through a slot extending up both sides of the hood face and across the top. If the painting is done mechanically, this is a satisfactory procedure in most cases; even if done manually, the operator can dress accordingly. Since the make-up air is taken directly from the outside, it is not heated and there is no appreciable heat loss. Needless to say, the supply rate should never exceed the exhaust rate, otherwise some of the contaminated air may be dispersed throughout the workroom generally. Anyone faced with the problem of having inadequate heating facilities at hand to heat properly the air exhausted from spray booths should consider seriously this approach to the problem before giving any thought to recirculation of some of the exhausted air. In addition to the many things that may happen to transform a properly engineered and safe recirculating arrangement to an unsafe one at some point in its life, there is the problem of removing the pigment satisfactorily. This is not accomplished by the conventional water curtain with which many booths are equipped.

Allen D. Brandt
Chief Industrial Hygiene Engineer,
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ABSTRACTS AND REVIEWS

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Marks' Mechanical Engineers' Handbook—Revised 5th Edition. Cloth bound, 6 x 9 inches, 2,236 pages. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. Price, $15.

CODE FOR FINNED TUBE RADIATION—The Institute of Boiler and Radiator Manufacturers has just published I-B-R testing and rating code for finned tube type of radiation. It provides a reliable and uniform procedure for measuring the output of all types of finned tube radiation regardless of the material from which they are made. It applies to steam or water heated room heaters consisting of a finned tube element. Heaters are designed for installation bare or with open type grilles or enclosures. Tests under this code may be conducted in the manufacturer's laboratory or in a laboratory selected by the manufacturer. The Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17, N. Y.

REVIEW OF OXYACETYLENE WELDING—To assist pipefitter welders who are required to take qualification tests under the ASME Boiler Code, Robert S. Green, Consultant, National Certified Pipe Welding Bureau, has prepared a pamphlet devoted to a review of oxyacetylene welding. A previous pamphlet covered metallic arc welding. The booklet gives a step-by-step story of the tests the candidate is to take and precautions he should emp'oy to pass the test. Written in a simple style and well illustrated, this 40-page pamphlet provides a good review of the subject. National Certified Pipe Welding Bureau, 1250 Avenue of the Americas, New York 20, N. Y. Price, 50 cents.

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DEGREE-DAYS FOR SEPTEMBER, 1951

(A) Airport readings; (C) City office readings;
(O) Readings at a point on outskirts of city.

HEATING AND VENTILATING'S 24th Year of Publication of Monthly Degree-Day Data

City	September		
	1951	1950	Normal
Abilene, Texas (A)	10	0	0
Albany, New York (A)	172	215	72
Albuquerque, New Mexico (A)	3	27	0
Alpena, Michigan (C)	265	268	222
Anaconda, Montana (C)	376	399	335
Asheville, North Carolina (C)	19	54	0
Atlanta, Georgia (C)	3	14	0
Atlant c City, New Jersey (C)	29	77	0
Augusta, Georgia (A)	0	15	0
Baker, Oregon (C)	181	236	258
Baltimore, Maryland (C)	23	61	0
Billings, Montana (A)	312	286	189
Binghamton, New York (C)	128	199	108
Birmingham, Alabama (A)	2	1	0
Bismarck, North Dakota (A)	310	232	222
Block Island, Rhode Island (A)	53	125	0
Boise, Idaho (A)	88	142	102
Boston, Massachusetts (A)	65	149	48
Bozeman, Montana (C)	379	460	336
Buffalo, New York (A)	158	155	75
Burlington, Iowa (A)	79	125	*(a)
Burlington, Vermont (A)	187	294	144
Butte, Montana (C)	441	447	344
Cairo, Illinois (C)	24	21	0
Charleston, South Carolina (C)	0	2	0
Charlotte, North Carolina (C)	9	38	0
Chattanooga, Tennessee (A)	3	11	0
Cheyenne, Wyoming (A)	306	300	240
Chicago, Illinois (C)	91	41	76
Cincinnati, Ohio (C)	33	46	0
Cleveland, Ohio (A)	107	77	27
Columbia, Missouri (A)	80	43	0
Columbia, South Carolina (C)	4	21	0
Columbus, Ohio (C)	62	68	0
Concord, New Hampshire (A)	198	287	168
Concordia, Kansas (C)	113	50	0
Dallas, Texas (A)	0	0	0
Davenport, Iowa (C)	105	55	0
Dayton, Ohio (A)	96	94	0
Deer Lodge, Montana (C)	398	417	399
Denver, Colorado (C)	139	169	72
Des Moines, Iowa (A)	147	65	0
Detroit, Michigan (A)	116	106	42
Devils Lake, North Dakota (C)	371	251	276
Dodge City, Kansas (A)	96	53	0
Dubuque, Iowa (C)	206	75	36
Duluth, Minnesota (C)	400	254	270
Eastport, Maine (A)	200	334	276
Elkins, West Virginia (A)	165	148	63
El Paso, Texas (A)	0	0	0
Ely, Nevada (A)	214	319	(a)
Erie, Pennsylvania (C)	102	101	36
Escanaba, Michigan (C)	284	257	243
Evansville, Indiana (A)	55	43	0
Fargo, North Dakota (A)	302	166	240
Fort Smith, Arkansas (A)	8	5	0
Fort Wayne, Indiana (A)	140	111	0
Fort Worth, Texas (A)	0	0	0
Fresno, California (A)	0	10	0
Galveston, Texas (C)	0	0	0
Grand Junction, Colorado (A)	36	69	0
Grand Rapids, Michigan (A)	188	110	57
Green Bay, Wisconsin (C)	257	212	132
Greensboro, North Carolina (A)	20	62	0
Greenville, South Carolina (A)	3	31	0
Harrisburg, Pennsylvania (A)	55	117	0
Hartford, Connecticut (A)	101	183	48
Hatteras, North Carolina (C)	0	8	0
Havre, Montana (C)	349	282	270
Helena, Montana (A)	388	360	251
Houston, Texas (C)	0	0	0
Huron, South Dakota (A)	260	146	123
Indianapolis, Indiana (A)	112	78	0
Jackson, Mississippi (A)	0	0	(a)
Kansas City, Missouri (A)	68	34	0
Knoxville, Tennessee (A)	9	27	0
La Crosse, Wisconsin (A)	208	138	96
Lander, Wyoming (A)	279	355	276

(a) Data not available.

City	September		
	1951	1950	Normal
Lansing, Michigan (A)	190	154	114
Lewiston, Maine (O)	102	300	165
Lincoln, Nebraska (C)	120	64	0
Little Rock, Arkansas (A)	6	14	0
Livingston, Montana (C)	336	360	227
Los Angeles, California (C)	0	0	0
Louisville, Kentucky (A)	45	40	0
Lynchburg, Virginia (A)	33	75	0
Macon, Georgia (A)	0	5	0
Madison, Wisconsin (C)	201	116	87
Marquette, Michigan (C)	319	249	225
Memphis, Tennessee (A)	10	10	0
Meridian, Mississippi (A)	0	2	0
Milwaukee, Wisconsin (A)	181	136	84
Minneapolis, Minnesota (A)	242	100	93
Moline, Illinois (A)	130	82	(a)
Montgomery, Alabama (A)	0	1	0
Nantucket, Massachusetts (A)	60	174	63
Nashville, Tennessee (A)	17	19	0
New Haven, Connecticut (A)	72	148	39
New Orleans, Louisiana (C)	0	0	0
New York, New York (C)	44	87	50
Nome, Alaska (A)	(a)	(a)	(a)
Norfolk, Virginia (C)	200	26	0
North Head, Washington (C)	273	284	255
North Platte, Nebraska (A)	198	133	42
Oakland, California (C)	65	59	90
Oklahoma City, Oklahoma (C)	23	3	0
Omaha, Nebraska (A)	128	77	0
Oswego, New York (C)	162	198	114
Parkersburg, West Virginia (C)	68	73	0
Peoria, Illinois (A)	119	62	3
Philadelphia, Pennsylvania (C)	24	85	36
Phoenix, Arizona (C)	0	0	0
Pittsburgh, Pennsylvania (C)	84	78	0
Pocatello, Idaho (A)	147	240	156
Portland, Maine (A)	195	312	162
Portland, Oregon (C)	47	90	105
Providence, Rhode Island (C)	71	163	63
Pueblo, Colorado (A)	115	87	6
Raleigh, North Carolina (C)	9	46	0
Rapid City, South Dakota (A)	274	233	144
Reading, Pennsylvania (C)	50	103	0
Red Bluff, California (A)	2	8	(a)
Reno, Nevada (A)	92	201	144
Richmond, Virginia (C)	17	54	0
Rochester, New York (A)	150	169	72
Roswell, New Mexico (A)	17	1	0
Sacramento, California (C)	3	8	0
St. Joseph, Missouri (A)	94	53	0
St. Louis, Missouri (C)	42	25	0
Salt Lake City, Utah (A)	64	135	18
San Antonio, Texas (A)	0	0	0
San Diego, California (A)	1	0	0
Sandusky, Ohio (C)	89	62	0
San Francisco, California (C)	122	172	114
Sault Ste. Marie, Michigan (A)	363	328	276
Savannah, Georgia (A)	0	1	0
Scranton, Pennsylvania (C)	114	169	60
Seattle, Washington (C)	110	128	186
Sheridan, Wyoming (A)	336	306	264
Shreveport, Louisiana (A)	0	2	0
Sioux City, Iowa (A)	195	96	33
Spokane, Washington (A)	163	144	192
Springfield, Illinois (C)	71	41	0
Springfield, Missouri (A)	69	61	0
Syracuse, New York (A)	145	202	96
Tacoma, Washington (C)	148	171	207
Terre Haute, Indiana (A)	108	64	0
Toledo, Ohio (A)	123	105	9
Topeka, Kansas (C)	84	32	0
Trenton, New Jersey (C)	45	118	0
Utica, New York (O)	181	222	182
Valentine, Nebraska (C)	249	182	93
Walla Walla, Washington (C)	39	76	30
Washington, D. C. (C)	22	55	0
Wichita, Kansas (A)	59	28	0
Williston, North Dakota (C)	351	274	270
Winnemucca, Nevada (C)	131	227	192
Yakima, Washington (A)	125	131	120

(a) Data not available.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Rees, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.

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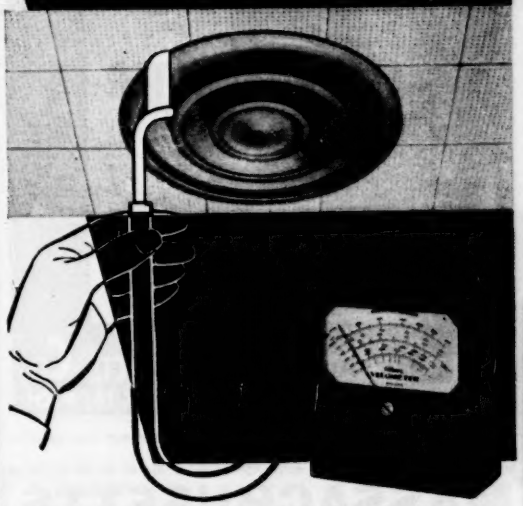

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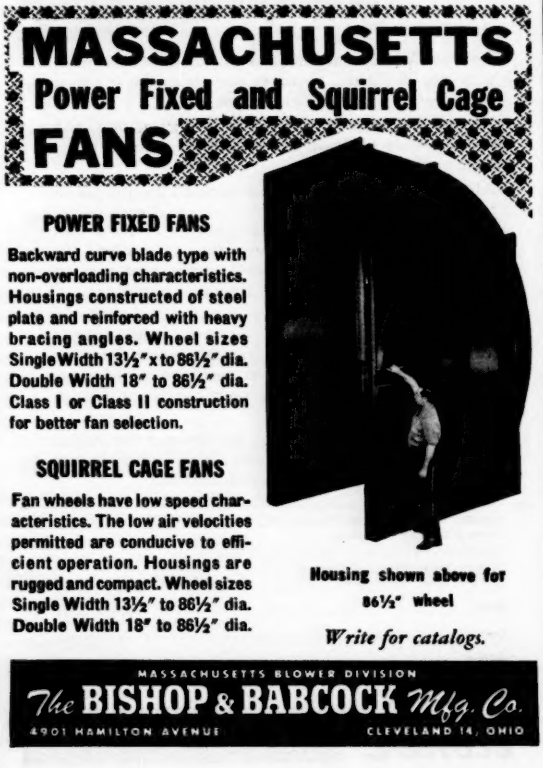
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• CORRECTION: The article, Recirculation of Cleaned Air from Cast Iron Machining, by Robert H. Avery, published in H&V for October, was originally presented as a paper at the 12th annual meeting of the American Industrial Hygiene Association and was published with the cooperation of the AIHA Quarterly.

Getting Personal

H. A. Blair

Howard A. Blair *(Control of Discharge Pressures Prevents Refrigeration Troubles*, page 61), a native of Cincinnati Ohio, received his E.E. degree from the University of Cincinnati in 1929.

Following graduation he joined Westinghouse, East Pittsburgh, Pa., as a graduate student. From 1931-34 he was test and development engineer for air conditioning and refrigeration apparatus, at the East Springfield, Mass., plant. During the next year he was with Metropolitan Air Conditioning Corp., New York City. After three years as service engineer with Westinghouse at Mansfield, Ohio, and two years at East Springfield, Mass., he served during 1944-46 as service manager, air conditioning division, Westinghouse Electric Elevator Co., Jersey City, N. J.

After Westinghouse acquired the B. F. Sturtevant Co., he was transferred in 1946 to Hyde Park, Mass., to become

manager of service and renewal parts department. Since 1950, he has been air conditioning service manager.

Mr. Blair is a member of ASHVE, and the honorary engineering societies of Tau Beta Pi and Eta Kappa Nu.

C. Frere

Clarence Frere *(Electric Panel Heating for the Home*, page 73), obtained his early schooling in Walla Walla, Wash., and received his BSME from Washington State College in 1940. He was employed by Consolidated Aircraft Corp., prior to being called for military service in World War II. During the war, he served with the Industrial Division of the Ordnance Department and also with the Air Force.

Since joining the General Electric Co. in 1947, he has devoted his time to development and application of equipment for electrical heating of homes. Mr. Frere's work recently was devoted to special electrical heating applications for the armed forces. Last June he was recalled for duty with the Air Force and was assigned to the Aircraft Air Conditioning Unit of Wright Air Development Center, Wright Field, Dayton, Ohio.

B. R. Buchhauser

Burton R. Buchhauser *(Refrigeration Improves Output in Carbonated Beverage Plants*, page 68) is sales promotion engineer for the Beverage Machinery Division of The Liquid Carbonic Corp., Chicago, Ill.

Following graduation from the Armour Institute of Technology, he studied at the Chicago Art Institute. Upon graduation from Armour, he spent several years in architectural and business machine engineering.

His association with Liquid Carbonic started in 1937. His work has been in the fields of design and research in beverage equipment, and supervision of refrigeration design and applications. At present his time is devoted to the supervision of advertising and promotion for all carbonated beverage and brewery equipment.

During World War II his activity centered on applications of water cooling equipment for export defense installations, cutting-oil refrigeration research, and the supervision of tool design for a varied war work program.

H. Wilson

Harry Wilson *(Auxiliary Heating for Churches*, page 86) received his Bachelor in Mechanical Engineering degree from the Brooklyn Polytechnic Institute in 1932. A year later he was cadet engineer with the Brooklyn Union Gas Company. At present he is commercial sales manager with that company.

For the past four years he has served as chairman of the Volume Water Heating Committee for the American Gas Association and he has presented a number of papers concerning the commercial field of the gas industry before that association. He has written a number of articles on volume water heating and space heating published in technical magazines.

Mr. Wilson has been active in developing and pioneering such equipment as a heat reclaimer for use in self-service laundries, a gas conversion burner for coal pot type water heaters, and fuel-door burners for commercial type boilers. He was active in promoting the use of immersion coil boilers for volume hot water supply.

During World War II he was an instructor in Job Methods Training for the War Manpower Commission.

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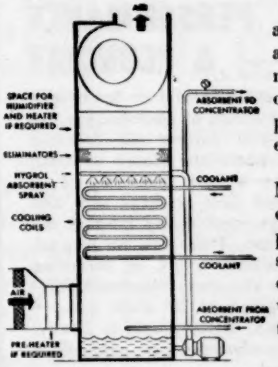

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COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

ASME MEETING—Annual meeting of the American Society of Mechanical Engineers, at Chalfonte-Haddon Hall, Atlantic City, N. J. C. E. Davies, secretary of the Society, 29 West 39th St., New York, N. Y. ..... **NOVEMBER 25-30, 1951.**

CHEMICAL EXPOSITION—23rd Exposition of Chemical Industries, at Grand Central Palace, New York. Charles F. Roth, manager of the International Exposition Company, Grand Central Palace, New York 17, N. Y. ..... **NOVEMBER 26—DECEMBER 1, 1951.**

CHEMICAL ENGINEERS MEETING—Annual meeting of the American Institute of Chemical Engineers, at Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary of the Institute, 29 West 39th St., New York 18, N. Y. ..... **DECEMBER 2-5, 1951.**

ASRE MEETING—Annual meeting of the American Society of Refrigerating Engineers, at the Hotel Roosevelt, New Orleans, La. M. C. Turpin, secretary of the Society, 40 W. 40th St., New York, N. Y. ..... **DECEMBER 2-5, 1951.**

HEATING WHOLESALERS' MEETING—Annual meeting of the National Heating Wholesalers' Association, at the Hotel Statler, Cleveland, Ohio. E. L. Wyman, executive secretary, 609 Commerce Building, Cleveland. ..... **DECEMBER 3-4, 1951.**

WARM AIR CONVENTION—38th annual convention of the National Warm Air Heating and Air Conditioning Association, at Hotel Cleveland, Cleveland, Ohio. George Boeddener, 145 Public Square, Cleveland. ..... **DECEMBER 5-6, 1951.**

PLANT MAINTENANCE SHOW AND CONFERENCE — 3rd plant maintenance show and conference, at Convention Hall, Philadelphia, Pa. Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. ..... **JANUARY 14-17, 1952.**

AUTOMOTIVE ENGINEERS MEETING — Annual meeting of the Society of Automotive Engineers, Inc., at the Hotel Book-Cadillac, Detroit, Mich. John A. C. Warner, secretary of the Society, 29 West 39th St., New York 18, N. Y. ..... **JANUARY 14-18, 1952.**

ELECTRIC ENGINEERING MEETING—Winter general meeting of the American Institute of Electrical Engineers, at the Hotel Statler, New York, N. Y. Secretary of the Institute, 33 West 39th St., New York 18, N. Y. ..... **JANUARY 21-25, 1952.**

ASHVE MEETING—58th annual meeting of the American Society of Heating and Ventilating Engineers, in St. Louis, Mo. A. V. Hutchinson, secretary of the Society, 51 Madison Ave., New York 10, N. Y. ..... **JANUARY 28-30, 1952.**

ASME MEETING—Spring meeting of the American Society of Mechanical Engineers, at the University of Washington, Seattle, Wash. C. E. Davies, secretary of the Society, 29 West 39th St., New York, N. Y. ..... **MARCH 24-26, 1952.**

OIL HEAT EXPOSITION—National Oil Heat Exposition, at Commercial Museum, Philadelphia, Pa., in conjunction with the 29th annual convention of Oil-Heat Institute of America, at the Benjamin Franklin Hotel. R. H. L. Becker, secretary of the Institute, 6 East 39th St., New York 16, N. Y. ..... **APRIL 14-18, 1952.**

ASME MEETING — Semi-annual meeting of the American Society of Mechanical Engineers, at the Sheraton Gibson Hotel, Cincinnati, Ohio. C. E. Davies, secretary of the Society, 29 West 39th St., New York, N. Y. ..... **JUNE 15-19, 1952.**

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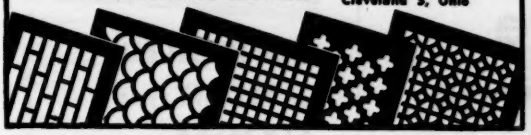

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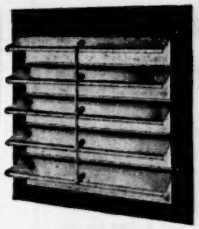

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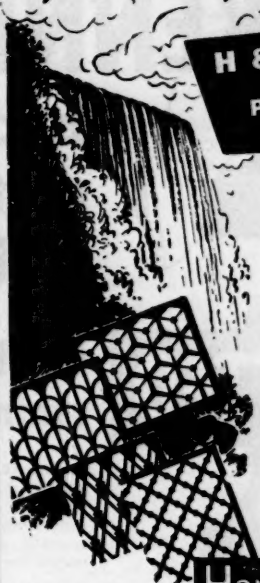

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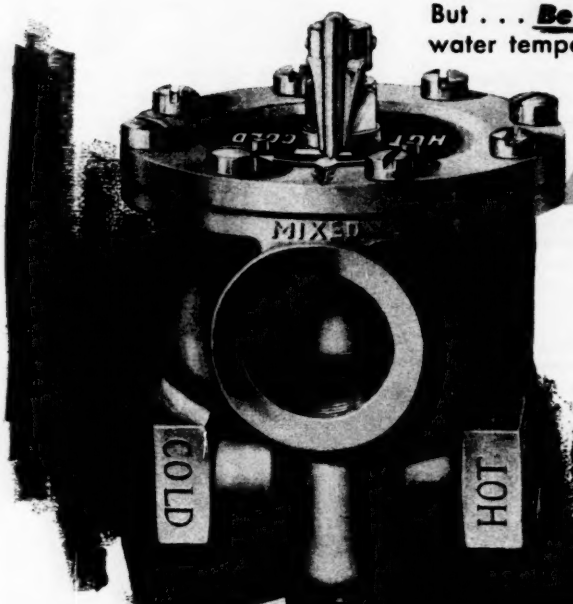

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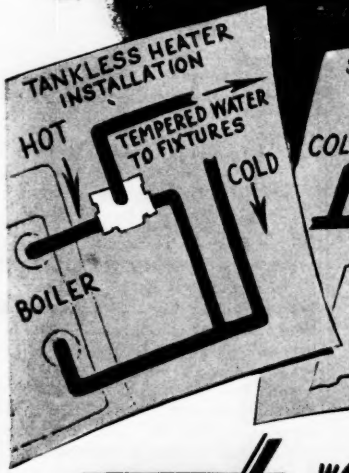

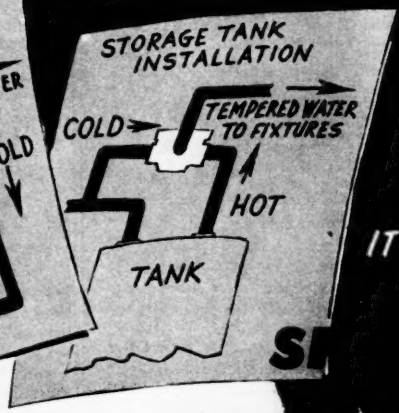

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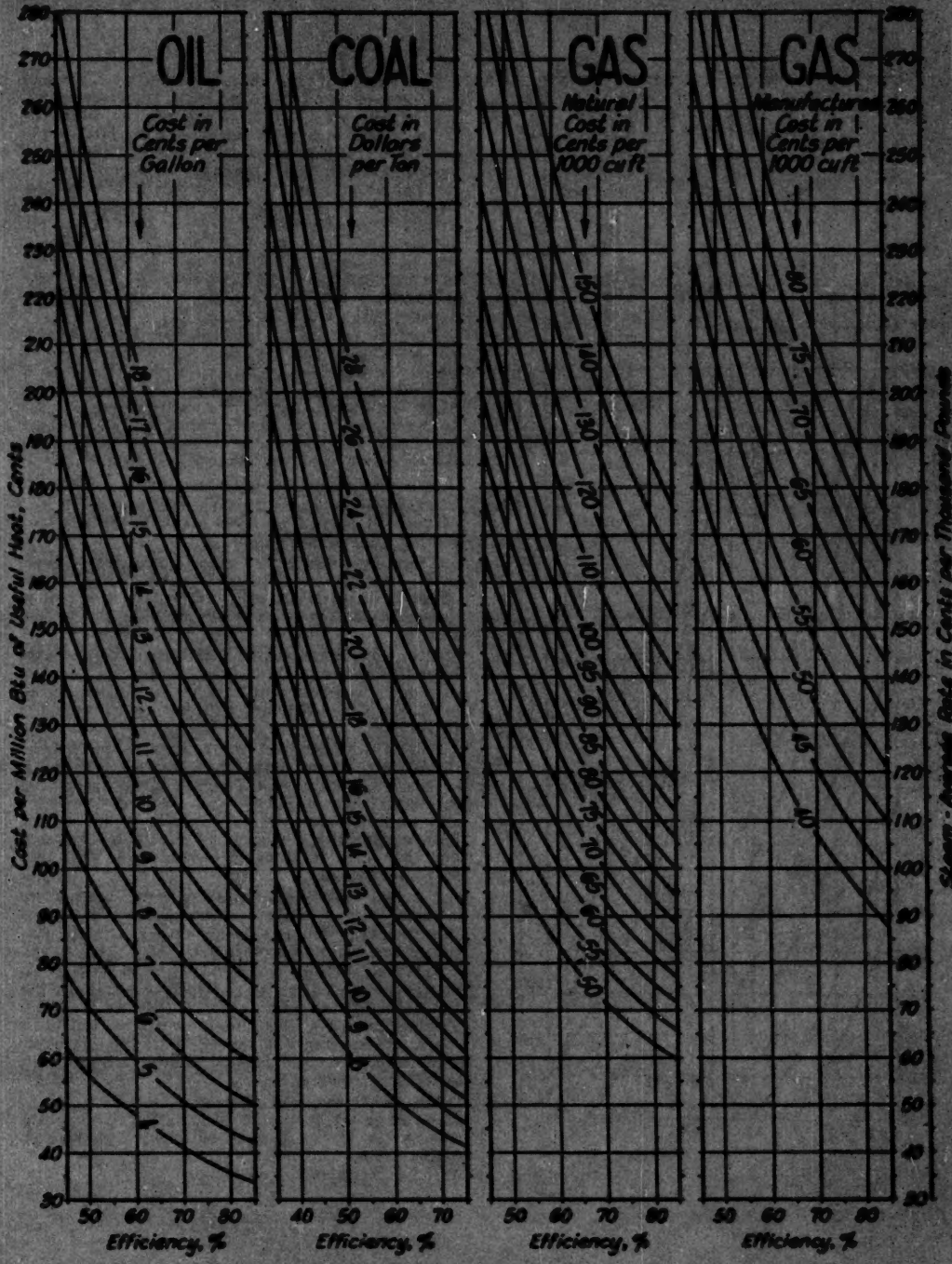
PLUMBING and HEATING . . . SAFETY VALVES and CONTROLS

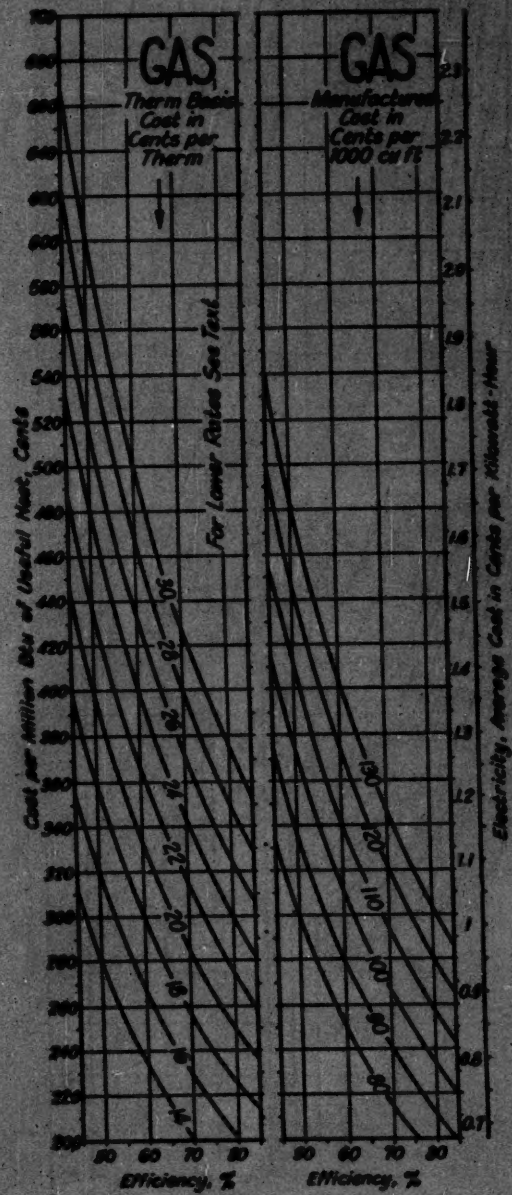
CHARTS FOR COMPARING FUEL COSTS



HEATING AND VENTILATING'S REFERENCE DATA

November, 1951

CHARTS FOR COMPARING FUEL COSTS



The accompanying charts are designed for finding, on a common left-hand scale, the cost per million Btu of useful heat from coal, oil, gas, electricity or purchased steam. In the case of the last two, an efficiency of 100% is assumed, so that the cost of useful heat is found by moving horizontally to the left opposite the unit cost. Unit heating values used in calculating the charts are: 141,000 Btu per gal of oil; 12,000 Btu per lb for coal, 2000 lb per ton; 1000 Btu per cubic foot for natural gas; 525 Btu per cu ft for manufactured gas; 1000 Btu per lb of steam; and 3413 Btu per kw-hr for electricity. A therm is 100,000 Btu, and a chart is included for gas sold on this basis.

For natural gas at rates higher than 150 cents per 1000 cu ft, use the chart for gas on the therm basis, dividing the natural gas rate by 10 and using the corresponding therm rate. For example, for $1.60 per thousand cubic feet natural gas, use the 16 cents per therm chart. Conversely, for therm basis gas at rates lower than 16 cents, multiply the rate by 10 and use natural gas chart.

Examples of the use of the charts are as follows:

Example—What would be the cost per million Btu of fuel oil burned at 65% over-all efficiency and costing 11 cents per gallon?

Solution—Enter the oil chart at the bottom scale at 65 and move upward to the intersection of the efficiency line with the curve for 11 cents per gallon, thence left and find the cost to be $1.20 per million Btu.

Example—What would the manufactured gas rate have to be, assuming it is to be burned at 75% efficiency, to produce heat at the same cost as oil burned at 70% efficiency and costing 10 cents per gallon?

Solution—On the oil chart, move upward from the 70 on the lower scale to the curve for 10 cents, thence horizontally to the right. Move upward on the manufactured gas scale at the extreme right and upward from the 75% efficiency line to the intersection with the previous horizontal line and find that a 40 cents per thousand cubic feet rate would be necessary.

Example—Electricity is available at 1.5 cents per kilowatt-hour in a certain community. How does this compare with gas to be burned at 80% efficiency and costing 80 cents per therm?

Solution—Using the extreme right-hand scale on the accompanying curve, and moving left from the 1.5 scale, find the cost per million Btu to be $4.38. For gas sold on a therm basis, using the left-hand chart, move upward from 80 to the intersection with the 80 line and find the cost with gas would be $8.75 per million Btu.

For gas, steam and electricity, the unit cost is an average of the total cost, including monthly stand-by or service charges and demand charges at various rates.

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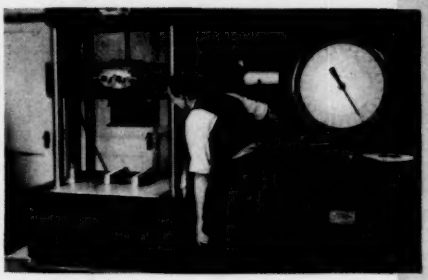

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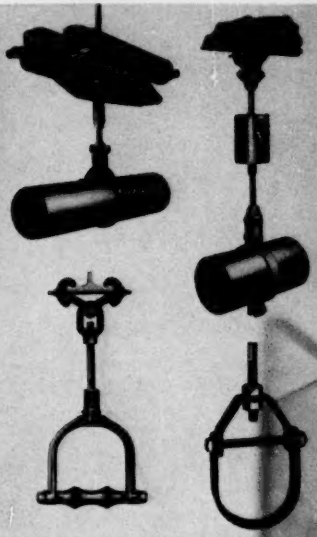

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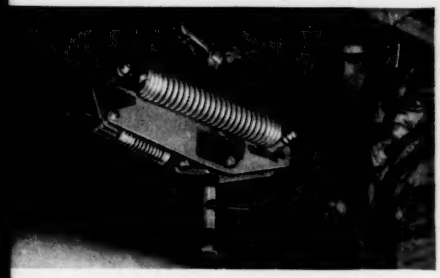

GRINNELL, ALONE, PROVIDES ENGINEERING ASSISTANCE IN DESIGN AND INSTALLATION

Grinnell makes available specialized knowledge in the computation of hanger loads and the selection of the correct supports. Engineers in the field assist with problems in erection of pipe hangers.

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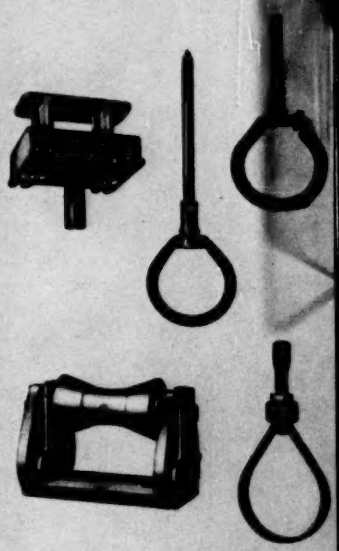

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